

## Chapter 1. Purpose and Need for Action

### 1.1 BACKGROUND

The Strategic Petroleum Reserve (SPR) is a national stockpile of petroleum (crude oil). Following the 1973-74 oil embargo, the SPR was established pursuant to the Energy Policy and Conservation Act of 1975 to protect the United States from interruption in petroleum supplies that would be detrimental to our energy security, national security, and economy. The SPR currently consists of four underground oil storage facilities along the Gulf Coast—two in Louisiana (Bayou Choctaw and West Hackberry) and two in Texas (Big Hill and Bryan Mound)—and an administrative facility in New Orleans, LA. At the storage facilities, crude oil is stored in caverns constructed by the **solution mining of rock salt formations (salt domes)**. The four SPR facilities have a combined current storage capacity of 727 million barrels (MMB) and an inventory of 688 MMB as of May 4, 2006.

**Glossary Terms:** To help readers more fully understand this Environmental Impact Statement, we have used bold type for technical and scientific terms the first time each appears in the text. The Glossary provides a full definition of each of these terms. In some cases, the definition of the term also appears in a highlighted text box near the first occurrence of the term in the text.

If the United States is confronted with an economically-threatening disruption in oil supplies, the President can use the SPR as an emergency response tool, transferring oil from the SPR into the commercial oil distribution systems. The SPR has been used twice under these conditions. First, at the beginning of Operation Desert Storm in 1991, the United States joined its allies in assuring the adequacy of global oil supplies when war broke out in the Persian Gulf. An emergency sale of SPR crude oil was announced the day the war began. The second instance was in September 2005 after Hurricane Katrina devastated the oil production, distribution, and refining industries in the Gulf regions of Louisiana and Mississippi. In addition to national energy emergencies, crude oil has been withdrawn many times from the SPR sites for other reasons. Small quantities of oil are routinely pumped from the storage caverns to test the reserve's equipment. In addition, oil has been removed from the caverns under the legal authority to "exchange" SPR crude oil with private companies, where the SPR ultimately receives more oil than it released.

The U.S. Department of Energy (DOE) conducted planning activities for the expansion of the SPR to 1 billion barrels under prior congressional directives in 1988 and 1990. The expansion planning directive in 1988 resulted in an initial plan entitled *Report to Congress on Expansion of the Strategic Petroleum Reserve to One Billion Barrels* (DOE 1989b). The expansion planning directive in 1990 likewise resulted in *Report to Congress on Candidate Sites for Expansion of the Strategic Petroleum Reserve to One Billion Barrels* (DOE 1991b) and the preparation of *Draft Environmental Impact Statement, DOE/EIS-0165-D* in 1992, which assessed five candidate sites for the expansion of the SPR to 1 billion barrels: Big Hill, TX; Stratton Ridge, TX; Weeks Island, LA; Cote Blanche, LA; and Richton, MS (DOE 1992a). DOE/EIS-0165-D is available on the DOE Fossil Energy Web site at <http://www.fossil.energy.gov/programs/reserves/spr/expansion-eis.html>. Prior to completion of the final EIS, DOE notified Congress that due to the existence of a large unfilled capacity in the SPR, DOE would be deferring any site selection decisions and expansion of the SPR until such time that oil fill of the SPR supported the need for further capacity development.

### 1.2 PURPOSE AND NEED

On August 8, 2005, the President signed the Energy Policy Act of 2005 (EPACT). Section 303 of EPACT states that:

“Not later than 1 year after the date of enactment of this Act, the Secretary shall complete a proceeding to select, from sites that the Secretary has previously studied, sites necessary to enable acquisition by the Secretary of the full authorized volume of the Strategic Petroleum Reserve.”

Thus, the purpose and need for agency action is to select and develop the sites to expand SPR capacity from 727 million barrels to 1 billion barrels.

### **1.3 DOE DECISION**

This environmental impact statement (EIS) will be used by DOE to make a decision on site selection for expansion of the SPR. As outlined more completely in Chapter 2 of this document, DOE is analyzing potential impacts from a new site at Bruinsburg, MS; Chacahoula, LA; Clovelly, LA; Richton, MS; and Stratton Ridge, TX; and two combinations of both Clovelly, LA, and Bruinsburg, MS. In addition, DOE is studying impacts from expanding capacity at Bayou Choctaw, LA, Big Hill, TX, and West Hackberry, LA.

### **1.4 NATIONAL ENVIRONMENTAL POLICY ACT PROCESS**

DOE has determined that the expansion of the SPR required by EPACT constitutes a major Federal action that is subject to the National Environmental Policy Act (NEPA). This EIS document has been prepared in accordance with NEPA, the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Parts 1500–1508), DOE NEPA regulations (10 CFR Part 1021) and **wetland** and **floodplain** regulations (10 CFR 1022). This EIS assesses the potential environmental impacts of the development of new SPR sites and the expansion of existing SPR sites and their associated infrastructures.

#### **1.4.1 Scoping and Public Involvement**

On September 1, 2005, DOE published a Notice of Intent to Prepare an EIS (70 FR 52088). The Notice of Intent invited interested agencies, organizations, Native American tribes, and members of the public to submit comments or suggestions to assist DOE in identifying significant environmental issues and determining the appropriate scope of the EIS. The notice also identified the dates and locations of public scoping meetings and stated that the public scoping period would run from September 1 to October 14, 2005.

As a result of the effects of Hurricanes Katrina and Rita on the Gulf Coast region, DOE issued a Notice to Extend the Public Scoping Period and Reschedule Public Scoping Meetings, extending the scoping period by 2 weeks, until October 28, 2005 (70 FR 56649, September 28, 2005). In the notice, DOE also announced the cancellation of the public scoping meetings in Hattiesburg and Pascagoula, MS, and provided new dates and locations for the other public scoping meetings. On October 27, 2005, Governor Haley Barbour of Mississippi requested the Secretary of Energy to include a new site in the EIS. In response, DOE extended the public scoping period until December 19, 2005 (70 FR 70600, November 22, 2005) and scheduled another scoping meeting.

#### **1.4.2 Summary of Public Scoping Process**

DOE held four public scoping meetings, as shown in table 1.3.2-1.

**Table 1.3.2-1: Scoping Meetings**

Location	Date	Proposed Sites Close to Meeting Location	Attendance	Speakers
Lake Jackson, TX	October 11, 2005	Stratton Ridge, TX	16	0
Jackson, MS	October 17, 2005	Richton, MS	24	4
Houma, LA	October 18, 2005	Chacahoula, LA, and Clovelly, LA	19	3
Port Gibson, MS	December 7, 2005	Bruinsburg, MS	21	7

The public scoping meetings were attended by approximately 80 people, some of whom provided oral and written comments. During the scoping period, DOE also met with Federal and state agencies with jurisdiction over the proposed new and existing SPR expansion sites in Louisiana, Mississippi, and Texas. At these meetings, DOE received comments from the agencies on environmental issues to be reviewed after review of scoping comments.

#### **1.4.2.1 Summary of Scoping Comments**

DOE received 67 scoping comments from 48 members of the public, companies, organizations, and government agencies. Comments focused mainly, but not exclusively, on the impacts of the construction and operation of the SPR facilities on water, land, and marine resources, and on various habitats of land and marine species. The following paragraphs summarize the major issues addressed in the comments. Unless otherwise noted, the discussions and analyses included in the draft EIS address the core topics of these comments. Copies of the comments received during the scoping period and complete public meeting transcripts are available from the Internet site <http://www.fossil.energy.gov/programs/reserves/spr/expansion-eis.html>.

**Public Health and Safety, Accidental Releases:** Commenters stated that DOE needs to address public health issues and the potential impacts on health and safety. One concern was the cumulative and secondary impacts the project presents for the increased risks of terrorism or accidents because of proposals to build liquid natural gas facilities near the proposed Stratton Ridge site. There is no longer a proposal to build such a facility near the Stratton Ridge site. The affected environment and analysis of potential environmental risks and public and occupational safety and health impacts are discussed in chapter 3, section 3.2.

**Land Use:** Commenters asked that DOE examine various potential impacts including loss of prime farmland, adverse effects on coastal areas, and land use changes at storage sites, pipelines rights-of-way, and other facilities. Commenters expressed concern that the proposed locations of the caverns for the Richton and Stratton Ridge sites would preclude other uses of the salt domes or affect mineral rights and expressed concern that the proposed Stratton Ridge site is located in the vicinity of security areas of existing and proposed industrial facilities. Affected land uses and site-specific analysis of potential land use impacts associated with the SPR sites are discussed in chapter 3, section 3.3. One commenter suggested that the EIS address impacts on the Gulf Islands National Seashore; however, the proposed action would not affect the Seashore.

**Geology:** Commenters expressed concerns about cavern creep and subsidence that might be caused by the creation of additional oil storage caverns at the already extensively developed Stratton Ridge salt dome, and suggested that the EIS evaluate this potential for adverse impacts. The affected environment and site-specific analysis of potential geology and soils impacts for each SPR site are discussed in chapter 3, section 3.4.

**Air Quality:** Noting that the Bayou Choctaw, Big Hill, and Stratton Ridge sites are in air quality nonattainment areas for the 8-hour ozone ambient standard and that they are subject to the Clean Air Act General Conformity rule and related state regulations, commenters asked that DOE estimate the potential emissions of volatile organic compounds and oxides of nitrogen during construction and operation at these sites and compare them to conformity threshold levels. Conformity analyses for the Bayou Choctaw, Big Hill, and Stratton Ridge sites are discussed in chapter 3, section 3.5. Other issues raised by commenters included cumulative air pollutant emissions and emissions from the oil blanket during solution mining. The affected environment and analysis of potential air quality impacts of construction and operation of the proposed action are discussed in chapter 3, section 3.5 and chapter 4.

**Water Resources:** Commenters requested that DOE evaluate the potential impacts of construction and operation of new oil storage caverns and underground injection wells on local aquifers, and the secondary and cumulative impacts of SPR expansion on wetlands and water quality, including water salinity. Commenters expressed concern about potential impacts to rivers and coastal areas. Commenters also requested analyses of potential impacts of water withdrawal from freshwater bodies for SPR expansion and operation, runoff from construction and operation of SPR facilities, and brine disposal in the Gulf of Mexico. Commenters suggested alternative sources of raw water intake for the Stratton Ridge and Richton sites. The affected environment and analysis of potential impacts to water resources from construction and operation of the Proposed Action are discussed in chapter 3, section 3.6 and chapter 4.

**Biological Resources:** Commenters asked that the EIS analyze the potential primary, secondary, and cumulative impacts of SPR expansion on a variety of habitats and species. Habitats of particular concern included wetlands and essential fish habitat (EFH). Fauna of concern included shrimp, oysters, and native fish species including those that are commercially important; migratory marine species including sharks and billfishes; water birds; migratory birds; and some threatened and endangered species such as the Bald Eagle, Diamondback Terrapin, Gulf Sturgeon, Red-bellied Turtle, Brown Pelican, and Louisiana Black Bear, and also candidate species. Commenters identified specific biological resource areas (e.g., forested wetlands, wildlife refuges, national seashores, national forests, and live bottoms crossed by offshore brine disposal pipelines) or specific flora or fauna species (e.g., specific locations of bald eagle nesting areas) in the project vicinity with respect to specific SPR sites, pipeline rights-of-way, raw water withdrawal areas, and brine disposal areas.

The affected environment and potential impacts to biological resources from construction and operation of the Proposed Action are discussed in chapter 3, section 3.7. The impact assessment methodology for plants, wetlands, and wildlife is described in section 3.7.1.1; for special status species (including threatened and endangered species, marine mammals, and managed fisheries) in section 3.7.1.2; for EFH in section 3.7.1.3; and for special status areas (including national wildlife refuges, wilderness areas, Coastal Wetlands Planning, Protection and Restoration Act areas, and coastal natural resource areas) in section 3.7.1.4. Potential impacts associated with specific areas of concern and specific species of concern identified by commenters are addressed in the site-specific impact analyses in section 3.7.

**Socioeconomics:** Commenters requested that DOE evaluate potential economic impacts on local communities, commercial and recreational fishing interests, tourism, and other economic interests in Louisiana, Mississippi, and Texas, particularly in areas affected by Hurricane Katrina. Similarly, commenters expressed concern about impacts to local industries by competition for workers and housing already in short supply. The affected environment and analysis of potential socioeconomic impacts of construction and operation of the proposed action are discussed in chapter 3, section 3.8.

**Cultural Resources:** Commenters addressed potential Native American concerns, particularly for the Richton and Bruinsburg sites. Commenters also identified themselves as having cultural affiliation with specific SPR sites, and requested that they be notified and that specific procedures be followed in the

event that cultural artifacts are discovered during SPR site development. They also suggested the need for archaeological and cultural surveys at the Stratton Ridge, Richton, and Big Hill sites should these sites be selected by DOE. The site-specific cultural resources affected environment and potential impacts to cultural resources for each SPR site are discussed in chapter 3, section 3.9. Specific procedures that would be implemented by DOE for the selected sites are also discussed in Section 3.9.

**Environmental Justice:** A commenter requested that DOE fully consider the environmental justice impacts of additional environmental risk and pollution associated with SPR expansion in low-income communities in light of the effects of Hurricane Katrina. Commenters also identified specific aspects (e.g., income level) of their communities. The affected environment and site-specific environmental justice impact analyses for each SPR site are presented in chapter 3, section 3.11.

**Alternatives:** Commenters proposed alternative locations for the storage of crude oil. The suggestions included sites in Louisiana, Texas, New Mexico, and Virginia. A discussion of the proposed action and alternatives, including a discussion of the statutory basis for selection of alternatives and alternatives considered but eliminated from detailed study, is included in chapter 2, section 2.7.

**Irreversible and Irretrievable Commitment of Resources:** A commenter expressed concern that development of SPR storage caverns would result in the irretrievable loss of salt resources that could otherwise be used for chlorine production. This issue is analyzed in chapter 3, section 3.3 and chapter 5.

**Cumulative Impacts:** Commenters requested that secondary and cumulative impacts of the Proposed Action and similar past, ongoing, or future actions, including cumulative impacts to water quality, biological resources, air quality, and socioeconomics, be addressed. Commenters identified specific actions (e.g., proposed liquefied natural gas facilities, future oil and gas production and pipelines) and requested that impacts of these actions be considered in the cumulative impacts analysis. Commenters also identified specific impacts (e.g., fish mortality caused by Hurricane Katrina) and requested that such impacts be considered in the cumulative impact analysis. Commenters suggested that the cumulative impacts analysis address specific activities (e.g., commercial fishing). Relevant actions and analysis of potential cumulative impacts of the proposed action are discussed in chapter 4.

**Mitigation:** Commenters requested that measures to avoid, minimize, and offset impacts (e.g., impacts to wetlands) of construction and operation of the Proposed Action be discussed in a mitigation section of the EIS. Commenters suggested specific mitigation measures be applied to specific SPR sites, pipeline rights-of-way, raw water intake areas, or brine disposal areas. The potential impacts and the associated mitigation measures are discussed in the same sections of the EIS (e.g., mitigation measures for impacts to wetlands are discussed in section 3.7 and appendix B).

#### **1.4.3 Final Environmental Impact Statement and Record of Decision**

DOE invites interested agencies, organizations, Native American tribes, and members of the public to submit comments on all aspects of this draft EIS. Locations and times of public hearings on the draft EIS will be announced in the Federal Register on May 26, 2006. Oral and written comments at those hearings are encouraged. Commenters are also encouraged to send written comments to Donald Silawsky, Office of Petroleum Reserves (FE-47), U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, DC 20585-0301, or electronic mail at [Donald.Silawsky@hq.doe.gov](mailto:Donald.Silawsky@hq.doe.gov). Please note that conventional mail to DOE may be delayed by anthrax screening. The public comment period will be open for 45 days following publication of the draft EIS in the Federal Register. Any comments received later will be considered to the extent practicable.

DOE will consider all comments on the draft EIS in preparing the final EIS in accordance with NEPA, CEQ NEPA regulations, and DOE NEPA regulations. It will include the oral and written comments received on the draft EIS and responses from DOE.

No decision on the proposed action will be made by DOE until a minimum of 30 days after the Environmental Protection Agency's notice of availability of the final EIS. After this period, DOE will issue a Record of Decision concerning the proposed action. The Record of Decision will notify the public of the alternative that DOE has selected and the reasons for that decision. DOE will publish the Record of Decision in the Federal Register and post it on the DOE Fossil Energy Web site at <http://www.fossil.energy.gov/programs/reserves/spr/expansion-eis.html>.

## **Chapter 2. Proposed Action and Alternatives**

### **2.1 INTRODUCTION**

The proposed action and alternatives are described below in section 2.2. Sections 2.3 through 2.5 describe the activities necessary to construct and operate a typical SPR storage site, the associated infrastructure, and the facilities needed at each potential new site and expansion site. Section 2.6 describes the no-action alternative. In addition, section 2.7 discusses the alternatives that have been eliminated from detailed study. Section 2.8 compares the environmental impacts of the alternatives.

### **2.2 PROPOSED ACTION**

EPACT Section 303 states that in evaluating sites for SPR expansion, DOE:

[s]hall first consider and give preference to the five sites which the Secretary previously addressed in the Draft Environmental Impact Statement, DOE/EIS-0165-D. However, the Secretary, in his discretion may select other sites as proposed by a State where a site has been previously studied by the Secretary to meet the full authorized volume of the Strategic Petroleum Reserve [1 billion barrels].

EPACT Section 301(e) directs the Secretary to "... acquire petroleum in quantities sufficient to fill ..." the SPR to 1 billion barrels. Consistent with these mandates, DOE's proposed action is to develop one or two new SPR sites, to expand petroleum storage capacity at two or three existing SPR sites, and to fill the SPR to its full authorized volume of 1 billion barrels. Sections 2.2.1 and 2.2.2 describe the potential development of new SPR sites and the potential expansion of existing SPR sites, respectively.

#### **2.2.1 Potential New Sites**

As required by EPACT Section 303, DOE has limited its review of potential new sites for expansion of the SPR to: (1) sites that DOE addressed in the 1992 draft EIS and (2) sites proposed by a state where DOE has previously studied a site. The following five potential new sites meet those conditions and are considered in this draft EIS:

- Richton, MS, and Stratton Ridge, TX, which were addressed in the 1992 draft EIS;
- Clovelly and Chacahoula, LA, which the Governor of Louisiana requested the Secretary of Energy consider; and
- Bruinsburg, MS, which the Governor of Mississippi requested that the Secretary of Energy consider.

While the 1992 draft EIS addressed the potential new salt dome sites at Cote Blanche, LA, and Weeks Island, LA, DOE's preliminary review of these sites for this draft EIS concluded that they are no longer viable due to the sale of the DOE's Weeks Island crude oil pipeline and its subsequent conversion to natural gas transmission.

### 2.2.2 Potential Expansion Sites

In addition to potential new sites, this draft EIS considers expanding the following three existing SPR sites:

- Big Hill, TX, which was addressed in the 1992 draft EIS; and
- Bayou Choctaw and West Hackberry, LA, which the Governor of Louisiana requested that the Secretary of Energy consider.

Figure 2.2.2-1 shows the location of the proposed new and expansion sites and their associated crude oil distribution complexes.

### 2.2.3 Alternatives

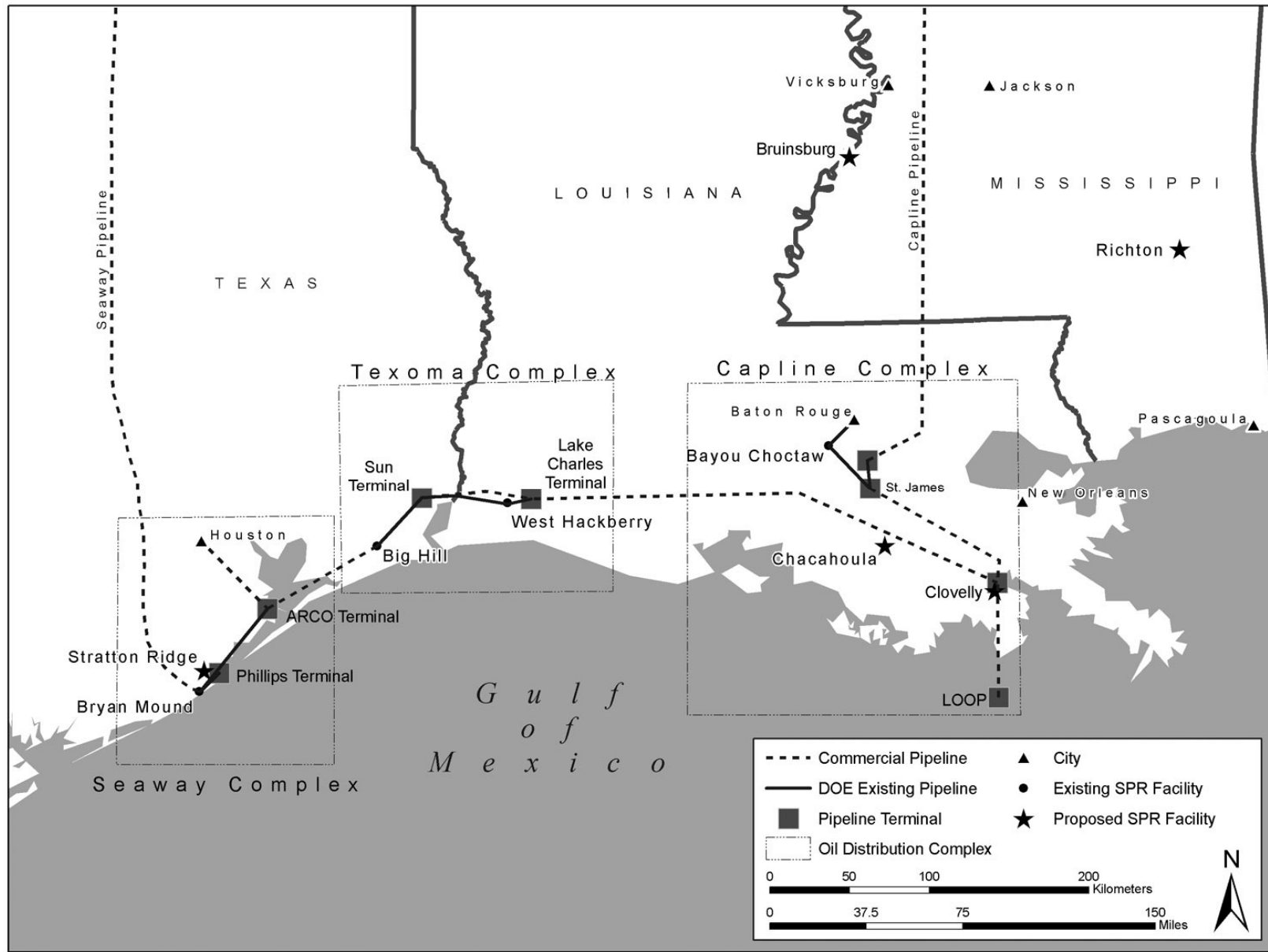
In developing the range of reasonable alternatives to fulfill its proposed action, DOE first considered expansions of the three existing storage sites, which would capitalize on existing site infrastructure and operations and thereby minimize development time and construction and operations costs. DOE, however, cannot reach its goal of 273 MMB simply by expanding capacity at existing sites. The amount of new capacity that can be developed at each existing site is limited by the physical size of the salt dome, the site's infrastructure for cavern development, the capacity of the commercial petroleum distribution infrastructure to handle an increased rate of oil withdrawal from the site, and other constraints. DOE has determined that, at most, it could create up to 153 MMB of new capacity by expanding existing SPR sites: DOE's site at Bayou Choctaw, LA, could be expanded by up to 30 MMB; Big Hill, TX, by up to 108 MMB; and West Hackberry, LA, by up to 15 MMB. Accordingly, DOE must develop one or more new SPR storage sites to meet its 273 MMB target and the alternatives discussed below are various proposals for combinations of expanded sites and new sites.

In examining potential new sites, DOE proposes to develop a new site with a capacity of 160 MMB, which is necessary to provide the capability to store two types of crude oil and support a drawdown rate of 1 million barrels per day. Five potential new sites have been designated for consideration in this draft EIS: Bruinsburg, MS; Chacahoula, LA; Clovelly, LA; Richton, MS; and Stratton Ridge, TX. All sites but Clovelly have the capability to provide 160 MMB of storage capacity. The Clovelly site is constrained to a maximum of 120 MMB by both the size of the salt dome and the existing commercial salt cavern storage operation on the dome. Due to the small size of the salt domes at Clovelly and Bruinsburg, DOE considers not only alternatives where Clovelly or Bruinsburg is the only new SPR site, but also alternatives with capacity at both Clovelly and Bruinsburg. From these various possibilities, DOE proposes the following alternatives set forth in table 2.2.3-1 below.

DOE has analyzed the potential impact of its proposed action for each potential location separately. This will permit the public and DOE decision-makers to understand the impacts unique to each site and each combination of sites. In its record of decision, DOE's decision-maker will determine which combination of sites best meets the Department's goal of 273 MMB of additional capacity.

As shown in table 2.2.3-1, for each alternative except for Clovelly and no-action, there are two scenarios for expanding the SPR to achieve the 1,000 MMB of storage capacity. The following subsections review the proposed new SPR sites and the existing SPR sites proposed for expansion.

Figure 2.2.2-1: Existing and Proposed SPR Facility Locations and Crude Oil Distribution Complexes



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**Table 2.2.3-1: Alternatives**

New Sites and Capacity	Expansion Sites and Added Capacity	Total New Capacity*
Clovelly, LA (120 MMB)	153 MMB Bayou Choctaw (30 MMB) Big Hill (108 MMB) West Hackberry (15 MMB)	273 MMB
Bruinsburg, MS (160 MMB)	115 MMB Bayou Choctaw (20 MMB) Big Hill (80 MMB)	275 MMB or 276 MMB
Chacahoula, LA (160 MMB)	West Hackberry (15 MMB)	
Clovelly (80MMB)/Bruinsburg (80 MMB)	OR 116 MMB	
Richton, MS (160 MMB)	Bayou Choctaw (20 MMB) Big Hill (96 MMB)	
Stratton Ridge, TX (160 MMB)		
Clovelly (90 MMB)/ Bruinsburg (80 MMB)	107 MMB Bayou Choctaw (20 MMB) Big Hill (72 MMB) West Hackberry (15 MMB) OR 104 MMB Bayou Choctaw (20 MMB) Big Hill (84 MMB)	277 MMB or 274 MMB
No-action alternative	None	None

\* DOE would not fill the SPR beyond 1 billion barrels if it developed more than 273 MMB of new capacity.

## 2.3 BACKGROUND ON CONSTRUCTION AND OPERATION OF SPR STORAGE SITES

An SPR storage site would consist of a number of individual systems that would play a role in storing and distributing oil. Crude oil storage caverns would be created in large salt domes. To create these storage caverns, **raw water** would be brought to the site through a RWI system. This raw water would be pumped into the salt dome to dissolve the salt in a process known as solution mining. Raw water would be supplied to expansion sites and new sites from surface water sources. This water would dissolve the salt and produce a brine solution, which would be disposed of through a brine disposal system. The systems and processes used to construct and operate SPR sites are described below and illustrated in figure 2.3-1 and figure 2.3-2. After a cavern has been successfully created, oil would be pumped in for storage through the crude oil distribution system until it would be removed through a process called drawdown and then redistributed.

Solution-mined caverns in salt domes have been used to store liquids and gases for more than half a century. In the early 1950s, salt caverns were first used to store crude oil in England and liquid petroleum gas in the United States, Canada, and several European countries. Natural gases began being stored in salt caverns in the United States and Canada in the 1960s. DOE has been using solution mining to develop caverns in the salt domes along the Gulf Coast since the 1970s, and it began filling the SPR salt caverns with crude oil in 1978.

**Salt domes** are subsurface geologic structures consisting of a vertical cylinder of salt, and may be anywhere from 0.5 to 6 miles (1 to 10 kilometers) across and up to 20,000 feet (6,100 meters) deep. Domes are formed when salt from buried salt pans flow upward due to its buoyancy.

**Raw water** is fresh surface water that is supplied to the site from a substantial water source.

**Brine** is water with a salt concentration greater than 35 parts per thousand. Sea water has a similar average concentration. In comparison discharged brine has a typical concentration of 263 parts per thousand.

### 2.3.1 Cavern Creation, Fill, and Drawdown System

Developing a cavern would take approximately 2 years, although multiple caverns can be created simultaneously. Because the caverns would be created simultaneously, it would take up to 5 years to complete the development of sixteen 10 MMB caverns. The top of each cavern would be located between 1,500 feet and 3,500 feet (460 meters and 1,607 meters) below the ground. Each cavern would be designed to hold 6.7 to 12 MMB of crude oil.

DOE would use a four-stage solution-mining process to create a cavern (figure 2.3-1). First, DOE would drill a pair of **concentric cased wells** into the salt dome, and then pump water through the wells until the **sumps** from each coalesce into a single sump so that water can be pumped down one well and brine displaced out through the other (figure 2.3-1, step I). During this process, **drilling mud** (which is not a hazardous waste) would be generated and deposited onsite, and brine would be discharged in one of two ways. Brine would be discharged into the Gulf of Mexico in accordance with the terms of applicable permits at any new site (except Bruinsburg) and the expansion at Big Hill. For the Bruinsburg, Bayou Choctaw, and West Hackberry sites, brine would be disposed of via injection wells that inject brine into deep non-potable groundwater aquifer systems. Brine disposal is described in section 2.3.3. As solution mining proceeds, any insolubles in the brine would drop to the bottom of the cavern.

**Concentric cased wells** are two wells, one located within the other. The two wells are separated by an inner casing and an outer casing, and the casings form two concentric rings.

A **sump** is the space below the bottom end of a well pipe where liquid collects.

Approximately 7 million barrels of brine are created for every 1 million barrels of cavern space created.

The second stage would involve developing the cavern chimney, which is the narrow upper part of the cavern illustrated in figure 2.3-1, step II. Water would flow into the well at the bottom of the developing cavern, and brine resulting from leached cavern walls would be pumped out at the top. DOE would carefully control upward cavern development to produce the desired cavern size and shape. This would be done by regulating water flow and varying the position of the injection piping.

In the third stage of cavern development, cavity growth would be directed downward by injecting a quantity of oil that floats on the water and blankets the cavern roof, thereby protecting the cavity from further upward solution mining (see figure 2.3-1, step III). This process works because the chemical composition of water differs from that of crude oil. Water is a polar substance, and it breaks the ionic bonds between the sodium and chloride, causing salt dissolution. In contrast, crude oil is nonpolar and does not break the bonds and dissolve salt. Thus, when the oil is injected and floats on the water at the top of the cavern, it prevents the water from dissolving salt at the top wall of the cavern toward the ground surface.

In the fourth stage of cavern development, the body of the cavern would be enlarged to its planned capacity by lowering the water injection point in the cavern (see figure 2.3-1, step IV).

DOE would monitor the cavern development process using computer and sonar instruments. After the initial cavity is created, a sonar **caliper** survey would verify that the cavern is developing as planned. During solution mining, DOE would use computer modeling to predict the size and shape of the cavern. The water injection level would be adjusted to create the desired size and shape. DOE would use sonar surveys two more times to measure each cavern and adjust the computer model accordingly. Upon

Figure 2.3-1: Cavern Creation in Construction of a Typical SPR Cavern

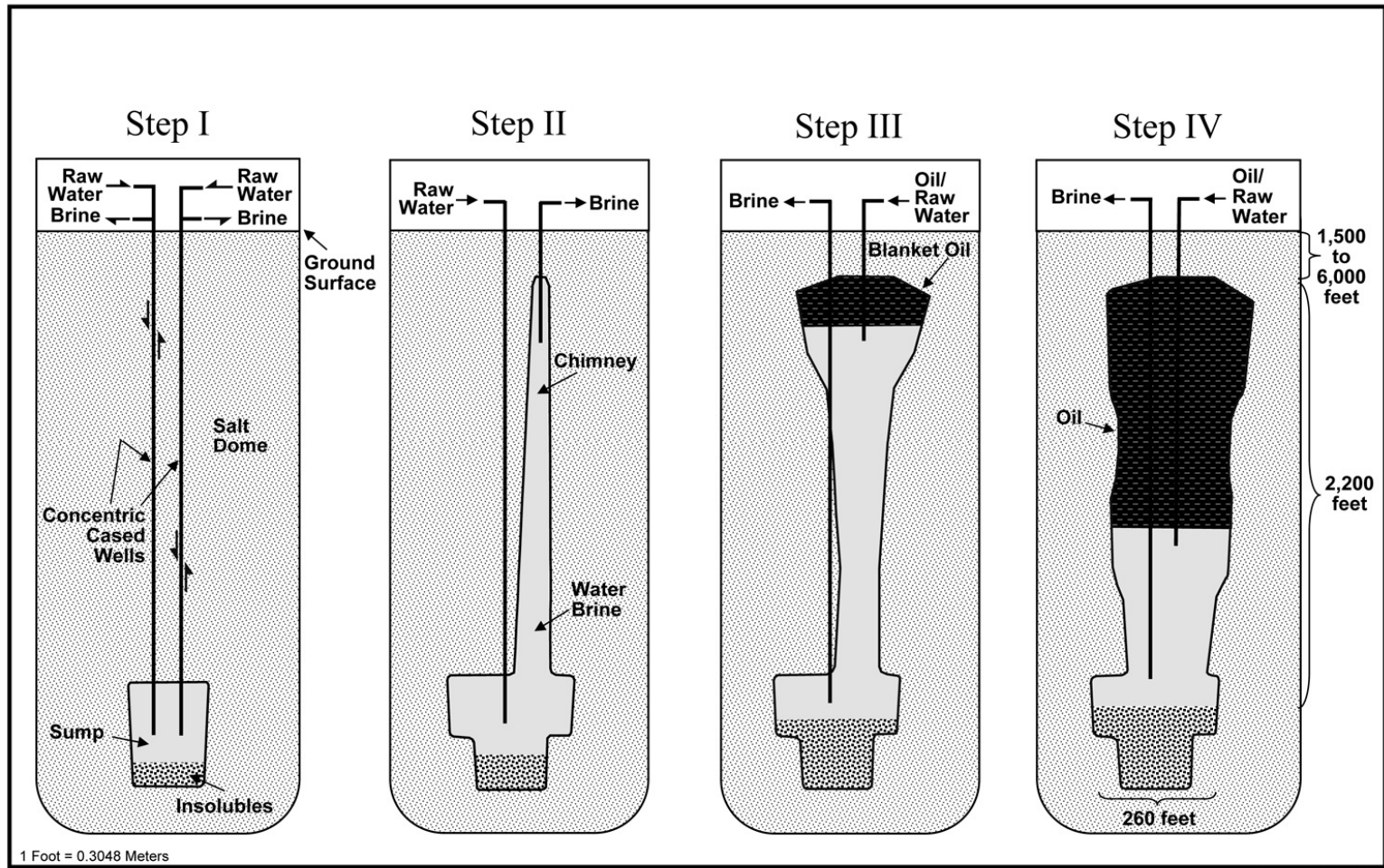


Figure 2-3 v9 - 04-20-06

1 foot = 0.3048 Meters

Figure 2.3-2: Filling a Typical SPR Storage Site

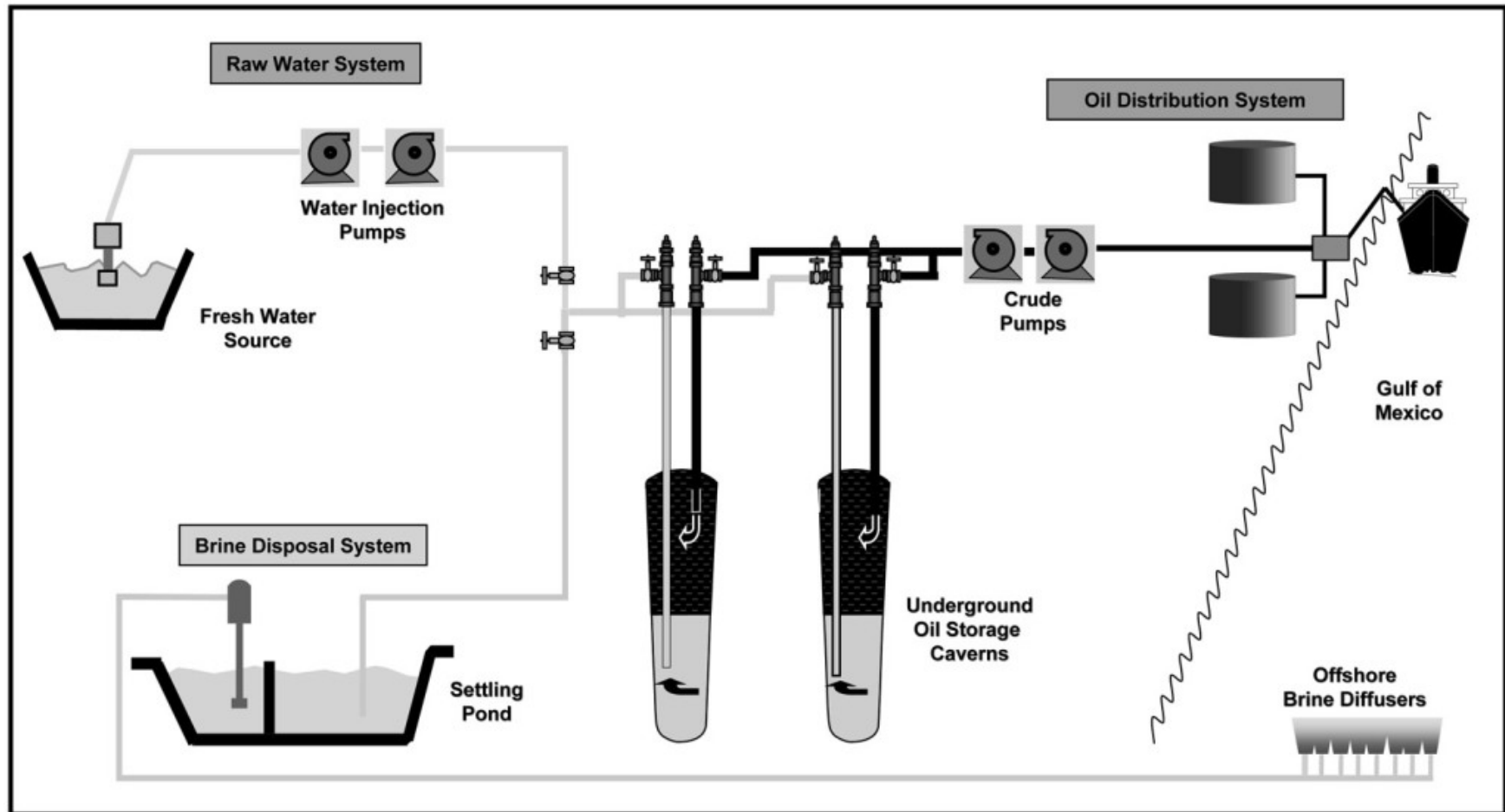


Figure 2-2 v5 - 11-11-05

completion, each cavern would be roughly cylindrical in shape, tapering slightly inward from top to bottom. A typical SPR storage cavern, with a planned storage capacity of 10 MMB, would be leached (solution mined) to an 11-MMB volume, approximately 2,200 feet (670 meters) high and 260 feet (79 meters) wide at the widest point (see figure 2.3-1).

DOE would test the structural integrity of the caverns in two phases. The first phase would involve two **hydrostatic tests** of each well in a cavern. This phase is designed to check the pressure-drop response of the entire cavern to gross leakage. The second phase would employ a nitrogen well-leak test on each well. This test, which would last at least 5 days, is designed to detect small leaks in the well walls and wellhead. DOE would approve a cavern for oil storage only if the testing demonstrates that total leakage would be less than 100 barrels of oil per year for each well entering the cavern. This is within the accuracy of current accepted evaluation techniques.

The fact that oil floats on water is the underlying mechanism used to move oil in and out of the SPR caverns. After completing integrity testing, DOE would fill the cavern with oil through one well as the brine is displaced from the second well (see figure 2.3-2). Oil would be delivered to the site through pipelines. Oil in the caverns would be stored until drawdown.

Besides being the most economical way to store oil for long periods of time, the use of salt caverns is also one of the most environmentally secure. The salt walls of the storage caverns are “self-healing.” Extreme geologic pressures make the salt walls rock hard. If any cracks were to develop, they would be closed almost instantly. In addition, the natural temperature difference between the top of the caverns and the bottom keeps the crude oil continuously circulating, helping maintain the oil at a consistent quality.

During drawdown, oil would be displaced by water and pumped through the site’s transfer metering station and distribution pipeline to the receiving terminal. Heat exchangers onsite would be used to cool the oil to prevent release of volatile organic compounds, hydrogen sulfide, and benzene when the oil is delivered from the storage sites into tanks at terminals. (Long-term storage in underground salt domes heats oil above the temperature at which it is originally stored.)

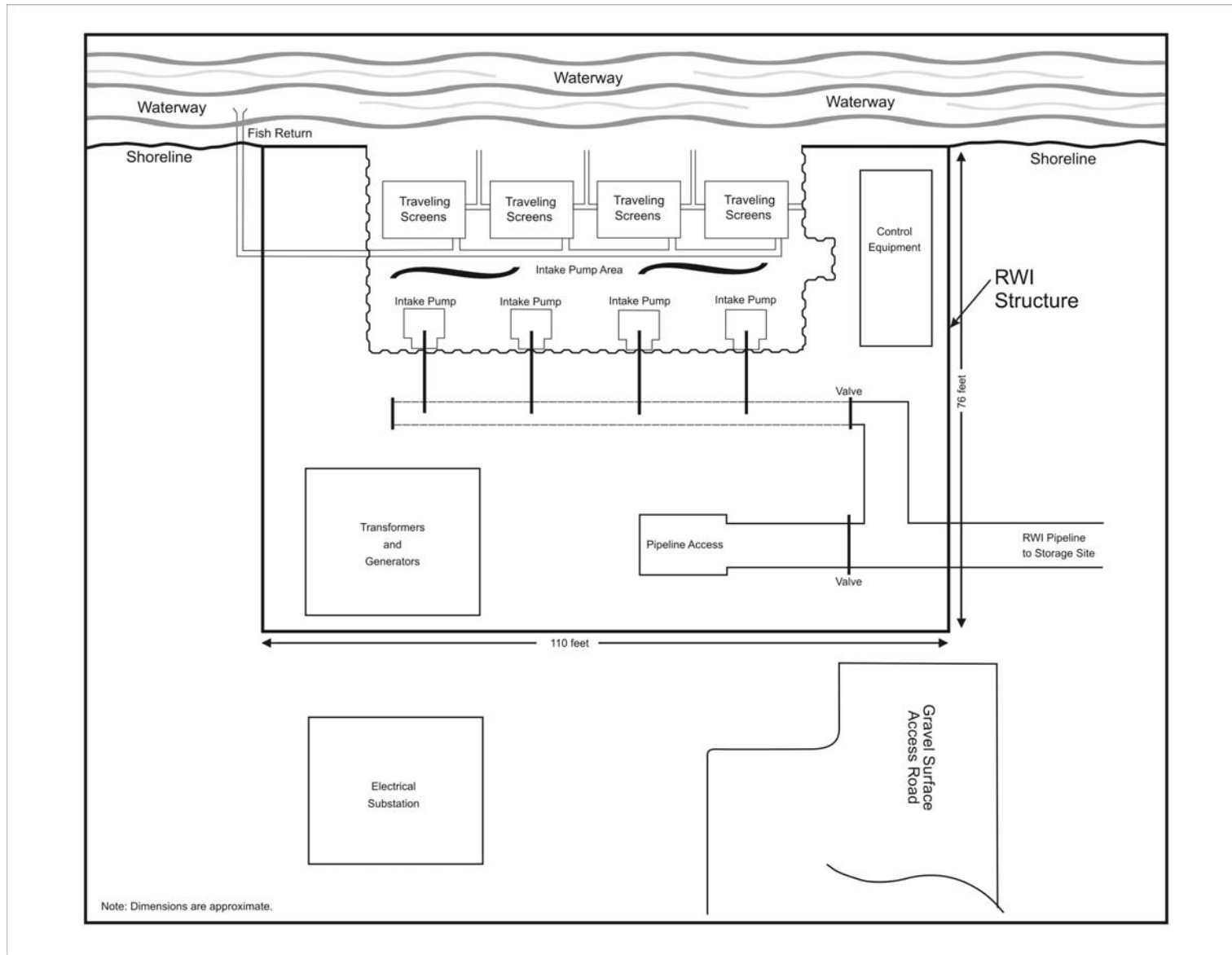
The layout of the caverns would depend on site characteristics, but generally it would reflect the current cavern layout at the Big Hill site (see section 2.5.2.). Cavern spacing would be based on specific criteria detailed in the Level III Design Criteria for the SPR that ensure cavern integrity and stability (DOE 2001a). These criteria detail minimum cavern center-to-center spacing, cavern pillar thickness, distances from the pillar thickness to the edge of the dome and to the property line, distance between the top of the cavern roof to the top of the salt, and the ratio of pillar thickness to final cavern diameter. A safety factor is also specified to allow for **borehole** deviation when drilling and for uncertainties regarding proximity to the edge of the dome.

A dike would surround the wellhead area at each cavern to contain and control any spills that might result from a manifold failure or blowout. Drains would be located on either side of the dike. The containment area would have the capacity to remove accumulated rainwater and would be drained to the stormwater drainage system.

### 2.3.2 Raw Water Intake System

The RWI system would supply raw water for both cavern solution mining and oil drawdown activities. The main component of this system, the RWI structure, would be located on a water source with sufficient flow to supply up to 1.2 million barrels per day (MMBD) or 50.4 million gallons per day of water for cavern solution mining and up to 1.2 MMBD for drawdown. A typical RWI structure would be a steel and concrete platform sufficiently elevated to withstand a 100-year flood (see figure 2.3.2-1). It

**Figure 2.3.2-1: RWI Typical Structure**



would have four 1,500-horsepower, vertical, centrifugal pumps, each with a capacity of approximately 0.46 MMBD to remove water from the water source. The water then would be transported through a pipeline to the SPR storage site. After the water reaches the site, 3,500-horsepower injection pumps would pump it to the caverns for solution mining or drawdown operations.

The RWI structure would have a concrete sump on an intake channel equipped with bar racks and traveling screens to remove debris and return aquatic life to the water source. The effective cross section of the screens would be sufficient to ensure a maximum intake velocity of 0.5 feet (0.15 meters) per second. The intake channel would be **rip rapped** according to U.S. Army Corps of Engineers (USACE) permit requirements to prevent shore erosion. The landward portion of the structure would be surrounded by a fence with security lights.

**Rip rapping** is the process by which rocks or other materials (rip rap) are placed along the banks of a body of water to prevent erosion.

In addition to the RWI pumps, two sealed, firewater, vertical, centrifugal, 100-horsepower pumps would maintain pressure in the RWI structure when the intake pumps are not operating. These pumps also would provide water at the RWI structure in case of fire. Power to the RWI would be provided on parallel, high-voltage, 34.5-kilovolt power lines supported on self-weathering 75-foot (23-meter) steel monopoles, however, based on the local power distribution system 115-kilovolt or 138 kilovolt power lines may be used. Typically, the new power line ROW would be built from the storage site to the RWI along a **right-of-way (ROW)** shared with the raw water pipeline. The ROWs for parallel 34.5-kilovolt power lines would be 60 feet (18 meters), and for parallel 115-kilovolt or 138 kilovolt power lines would be 150 feet (46 meters). Power to the RWI would be provided from the storage site substation or from nearby existing power lines.

### 2.3.3 Brine Disposal System

DOE would use two methods of disposing of brine produced during cavern solution mining: ocean disposal or injection wells. At Big Hill and each of the proposed new sites except Bruinsburg, the brine would be directly discharged into the Gulf of Mexico through a brine **diffuser** system. Brine would be displaced from caverns into a **brine pond** with a high-density polyethylene liner, where **anhydrites** would be separated from the brine by gravity settling. From this pond, the brine would flow into a different area of the pond or into a second pond or area, where any residual oil floating on the surface of the brine would be skimmed off. Oil collected by the **skimmer** boom would be stored temporarily in a waste oil tank, and after evaluation, it would be returned to inventory. Any oil failing evaluation would be disposed of offsite as waste (see section 2.3.10).

**Anhydrites** are mineral, anhydrous calcium sulfates (chemical formula  $\text{CaSO}_4$ ), occurring naturally in salt deposits. Anhydrite is much less soluble than salt, so anhydrite solids must be removed from brine before brine can be disposed of in the ocean or injected into underground wells.

Finally, the brine would be pumped into the brine disposal pipeline. The brine would be treated with ammonium bisulfite, which scavenges dissolved oxygen, thereby reducing corrosion in the brine disposal pipeline. Vertical, centrifugal pumps would pump at a rate of up to 1.2 MMBD to the disposal point.

For ocean disposal, the brine disposal pipeline would be buried below the bottom of the Gulf of Mexico and extend until the water is at least 30 feet (9 meters) deep. After the brine reaches that point, it would be discharged underwater vertically through a diffuser with 3-inch (7.6-centimeter) nozzles mounted vertically and spaced 60 feet (19 meters) apart. The diffuser would extend over 4,000 feet (1,200 meters) beyond the pipeline. The diffuser would have up to 60 exit ports that can be opened or closed in order to maintain a minimum brine exit velocity of 30 feet (9.1 meters) per second. Each nozzle on the diffuser

would be equipped with a flexible rubber hose that would extend 4 feet (1.2 meters) above the Gulf floor and with a diffuser guard designed to prevent interference with shrimping and other fishing activities. Discharged brine would have a salinity of about 263 parts per thousand, whereas the seawater in the gulf has an average salinity of 35 parts per thousand.

Under the proposed expansion at the Bayou Choctaw and West Hackberry sites, brine would be disposed of using existing and proposed new brine injection wells. Brine disposal at West Hackberry would use the existing brine disposal wells, while brine disposal at Bayou Choctaw would use the existing and up to six new brine injection wells. At the West Hackberry site, existing caverns would be purchased, and brine would only be disposed of during the oil fill. An underground injection system also would be used to dispose of brine from the proposed Bruinsburg site. The process for moving the brine to underground injection wells would be similar to that of the Gulf of Mexico disposal method—first to separating ponds before being pumped into disposal pipelines—except for the final disposal point. In this method, the brine would be injected into wells specifically designed and permitted to inject brine into deep non-potable groundwater aquifer systems.

### 2.3.4 Crude Oil Distribution System

SPR storage sites would be connected to a crude oil distribution system as a means of filling caverns for storage and distributing oil during drawdown. The crude oil distribution system would consist of a series of onsite and offsite pipelines and pumps connecting to an existing oil distribution network. To accommodate some of the new sites being considered, the existing distribution network also may be expanded to include new **tank farms**, terminals, and other equipment. The existing SPR storage facilities are linked to three major Gulf Coast crude oil distribution complexes (see figure 2.2.2-1). The proposed new or expanded SPR storage facilities at Bruinsburg, Chacahoula, Clovelly, Richton, and Bayou Choctaw would be connected to the Capline Complex. The proposed new SPR storage facility at Stratton Ridge would be connected to the Seaway Complex. The existing and proposed SPR storage facilities at West Hackberry would be linked to the Texoma distribution complex. The existing and proposed SPR storage facilities at Big Hill would be linked to both the Seaway and Texoma complexes. Each of these complexes includes oil refineries, pipelines, and marine oil terminals on the Gulf Coast. During an emergency drawdown of the SPR, crude oil would be transported by pipeline, barge, or tanker.

### 2.3.5 Site Support Structure and Equipment

To support storage site operations, several types of structures and equipment would be constructed at the site as needed. The following buildings would be needed to support operations and maintenance:

- Office and control room;
- Maintenance shop and warehouse;
- Crude oil, raw water, and brine pump enclosures;
- Sample storage building;
- Laboratory; and
- Security buildings.

These buildings typically would occupy a 35,000-square-foot (3,250-square-meter) area. To facilitate construction and site operations, DOE would build roads at the site. The roads generally would have two 10-foot (3-meter) lanes with 6-foot (1.8-meter) shoulders. Total roadway length for a site would average 5.1 miles (8.2 kilometers). DOE also would need miscellaneous surface facilities such as pump pads, piping manifolds, maintenance yards, **laydown yards**, and parking lots. Total storage facility surface area for new sites would range from 170 to 270 acres (69 to 110 hectares). Expansion sites range from

250 to 570 acres (100 to 230 hectares), and areas that would be added by proposed expansion would range from 96 to 240 acres (39 to 97 hectares).

An SPR site also would need an electrical substation, sewage treatment facility, lightning-protection system, and fire-safety system. The fire-protection system would receive its water supply from either the RWI structure or an onsite tank. In a fire, the water would be distributed through underground piping. The system would include a foam (aqueous film-forming foam) spray system for controlling fires at the oil injection pump pads and oil loading center, an automatic sprinkler system inside buildings, and an onsite fire truck.

All SPR sites would be equipped with security systems and staffed by protective personnel. The sites would be completely fenced with 7-foot (2.1-meter) chain-link fence and equipped with site perimeter surveillance and detection systems. With the exception of Clovelly, the sites would maintain a 300-foot (91-meter) visual clear zone with perimeter lighting. Personnel and vehicle entry would be restricted. Site entrances would be equipped with vehicle barriers and entry portals for personnel screening. Employee and visitor parking would be provided outside the controlled area.

Electrical power would be required for basic construction and operational activities, quarterly equipment testing, and annual testing of drawdown capabilities. The number of pumps used at any one time and their energy requirements would vary depending on the number of caverns being developed, the type of activity, and the conditions of each pipe **casing**. Cavern development would be the most energy-intensive activity, averaging approximately 12 million kilowatt-hours per month for a 16-cavern site. The RWI, brine disposal, and oil fill and distribution systems would be powered by electric pumps. During cavern development, pumps would usually run 24 hours each day. Oil-fill energy requirements would be about 6 million kilowatt-hours per month. During standby periods, energy requirements would be about 1 million kilowatt-hours per month for a 16-cavern site. During standby periods, energy requirements would be about 0.5 million kilowatt-hours per month. During drawdown periods, energy requirements would be greater than for oil fill and less than for cavern development, depending on the rate of drawdown.

High-voltage 115-kilovolt, 138-kilovolt, or 230-kilovolt power lines would be built to supply the substation at a new SPR storage site. Two lines would be constructed for each site, generally using new ROWs or along ROWs shared with pipelines or roads. The ROW for a single 115-kilovolt or 138-kilovolt power line would be 100 feet (30 meters) and the ROW for parallel 115-kilovolt or 138-kilovolt power lines would be 150 feet (46 meters). The ROW for a single 230-kilovolt power line would be 100 feet (30 meters) and the ROW for a parallel 230-kilovolt power line would be 200 feet (60 meters). A three-line single circuit would be supported on self-weathering 75-foot (23-meter) steel monopoles spaced at 600 to 900-foot (183- to 274-meter) intervals.

### **2.3.6 Storm Protection Measures**

DOE has established emergency response plans at all existing SPR storage facilities to address major storm events such as hurricanes. SPR staff would monitor weather and potential storms continually. If a hurricane were projected to hit an operational storage facility, the threat level would be assessed and the appropriate emergency response plan would be initiated. During threats, all loose materials onsite, including materials at the laydown areas, would be tied down or relocated to a secure area. Windows on buildings would be secured with energy efficient storm shutters or prefabricated plywood covers. Storage tanks would be checked to ensure that they are storing enough material to effectively weigh them down and prevent serious damage. If the storage tanks are found to be too light, water would be added to them. Finally, all nonessential personnel would be released from work, and site operations would be suspended.

Storm damage could potentially affect SPR storage facilities and support infrastructures, disrupt workforces, and result in communication interruptions. The effects of storm damage to a SPR storage facility can be best demonstrated by recent events. Storm protection measures—including activating back-up communication centers—were implemented when major Hurricanes Katrina (Category-4 landfall in Louisiana) and Rita (Category-3 landfall on the Louisiana/Texas border) devastated parts of the Gulf Coast region in August and September 2005. In addition to causing structural, economic, and social damage to a tri-state region in the Gulf Coast, these hurricanes shut down most crude oil and natural gas production and affected the ability of suppliers to get gasoline to national markets due to the closure of critical refineries in the region. Several SPR storage sites were directly affected, sustained some damage, and many employees were displaced from their homes. Notwithstanding, SPR operations were able to be restored almost immediately. The Oil Exchange Program providing crude oil to refiners in order to continue operations commenced in less than three days after Hurricane Rita and five days after Hurricane Katrina at which time President Bush declared a SPR drawdown—an action that has occurred only twice in 30 years. This demonstrates the effectiveness of planned SPR storm protection measures and of the resilience of SPR infrastructure to sustain short-term damage from major storm events.

### 2.3.7 Construction in Uplands

As described above, construction activities generally would include site preparation, development of RWI and brine disposal systems, cavern creation, development of any new oil pipelines needed to connect to existing distribution networks, and construction of support structures and equipment. The actual activities undertaken would depend on the sites selected and existing facilities at each site. The following sections describe required activities in developing a typical new SPR facility in **uplands**. Certain of these activities also pertain to expansion of existing facilities, particularly where new caverns would be developed.

**Uplands** refer to generally dry land that is different from, marsh, swamp, and wetlands.

#### *Clearing and Grubbing*

Construction of a new SPR facility would begin with clearing and **grubbing** the site. Clearing would consist of felling, trimming, and cutting trees into sections and removing surface vegetation, rubbish, and existing structures. Materials removed generally would be disposed of at an approved offsite facility. In most cases, onsite burning or disposal would not be permitted. Grubbing would include removing roots, stumps, brush, and general debris. As part of this work, topsoil also would be removed. Generally, uncontaminated native topsoil would be stockpiled on the site for use in restoring sloped areas, which then would be seeded with native vegetation to control erosion. Waste materials would be recycled or disposed of offsite.

All the land within a new site and within the 300-foot (91-meter) security buffer would require clearing and grubbing for initial site construction activities. These operations generally would require two crews (an onshore construction crew is about 52 people). Depending on the density of trees and brush, the clearing and grubbing would be completed in approximately 100 working days.

#### *Grading and Stabilization*

Grading and general embankment, stabilization, and compaction operations would begin as soon as clearing and grubbing are completed. As adequate site areas are cleared, rough grading (i.e., moving dirt from high areas of the site to lower areas) would begin. For a typical 300-acre (120-hectare) site, estimated daily production of graded materials would be 3,000 cubic yards (2,300 cubic meters) for two 300-horsepower dozers (short haul) and 2,500 cubic yards (1,900 cubic meters) for two 14-cubic-yard (11-cubic-meter) scrapers (long haul). Rough grading would require 5 to 10 working days. As areas of

the site are cut to subgrade levels, the soil would be stabilized with lime and then compacted. Two crews would stabilize approximately 1 acre (0.4 hectare) per day, requiring 130 working days for this operation. Placing and compacting embankment material would be done at a rate of 2,000 cubic yards (1,500 cubic meters) per day, requiring approximately 60 working days.

### 2.3.8 Construction in Wetlands

At the proposed Chacahoula and Clovelly sites, the majority of construction would occur in saturated or open-water wetlands. Construction would require dredging and filling of wetlands. Dredging is the removal of materials from the bottom of a body of water. It would be required at Clovelly for the construction of 9 of the 16 proposed caverns. At both Chacahoula and Clovelly, fill areas would be created for gravel roadways, onsite pipelines, onsite buildings and structures, and drilling pads above each well. The pipelines and roadways would be co-located to minimize construction impacts. The foundations of buildings would be placed on concrete or wooden piles driven into the earth below the water.

### 2.3.9 Pipeline Construction

Offsite pipelines for brine disposal, raw water, and crude oil distribution would be buried. In preparation for pipeline construction, DOE would clear the ROW, which requires preparation similar to that required for construction. DOE would give all possible consideration to preserving trees in the ROW. DOE also would grade the ROW to facilitate laying the pipeline, and would build temporary facilities such as roads and bridges for use during pipeline construction.

Five basic modes of pipeline construction would be used in uplands and wetlands through which a pipeline from any proposed site could pass. The method chosen for a particular pipeline would depend on terrain, pipe size, and presence of ground and surface water. The five modes are described below:

- **Conventional Land Lay:** This method generally would be used for pipe installation at higher elevations where groundwater or surface water conditions would not prevent the use of heavy equipment. The pipe would be installed in ditches excavated by backhoes and ditching machines. The pipeline would be assembled and lowered into the ditch using side-boom tractors and other equipment. The ditch then would be backfilled, returning the terrain to its original contour.
- **Conventional Push Ditch:** This method would be used in marshland areas where water depths are reasonably predictable. Timber mats support the heavy equipment used to create ditches of sufficient depth for pipeline installation. The pipeline would be assembled at the push site, on high ground, on a barge, or on a temporary platform, and then pushed into the ditch. Floats would be used to push the pipe into position. When these floats are removed, the concrete-coated pipe would sink to the bottom of the ditch. Returning the ROW to its original contour depends on the success of the backfilling and the ditch slope.
- **Flotation Canal:** For this method, which requires a minimum of 6 feet (1.8 meters) of water, a canal would be created to accommodate barges and floating equipment. The pipe would be installed in the canal through a sequential assembly operation on a barge deck. The canal would not be backfilled.
- **Modified Push Ditch:** This method would be most applicable in areas with predictable water levels such as coastal **marshes**. Shallow-draft barges would excavate a canal. A larger push barge would be used as a platform to assemble the pipe, and then, with flotation buoys, the pipe would be floated into the canal. The pipe is allowed to sink to the bottom of the canal when the flotation buoys are removed. Finally, the canal would be backfilled.

- **Directional Drilling:** This method is used for laying in a pipeline beneath major road and water crossings. The main advantage is that during construction, the method avoids disruption to traffic and sensitive environmental features. Using a slanted drill, construction workers would drill a pilot hole on one side of the crossing and then repeat this process on the other side. After drilling the pilot holes, workers would expand them to create sufficient space for the crude oil pipeline.

Pipeline construction in the Gulf of Mexico generally would require a trench about 20 feet (6.1 meters) below the ocean floor and 12 and 6 feet (3.7 and 1.8 meters) wide at its top and bottom, respectively. Pipeline construction would differ for coastal waters (i.e., within water depths of 12 to 15 feet [3.7 to 4.6 meters]) and offshore waters (i.e., beyond water depths of 12 to 15 feet [3.7 to 4.6 meters]). In coastal water, a mechanical dredge (e.g., clam bucket or dragline dredge) would excavate the pipeline route. Afterward, the pipeline would be assembled sequentially on a pipelay barge and then pushed off the pipe ramp. Flotation buoys would keep the pipeline suspended in the water until the pipeline was allowed to descend into the ROW.

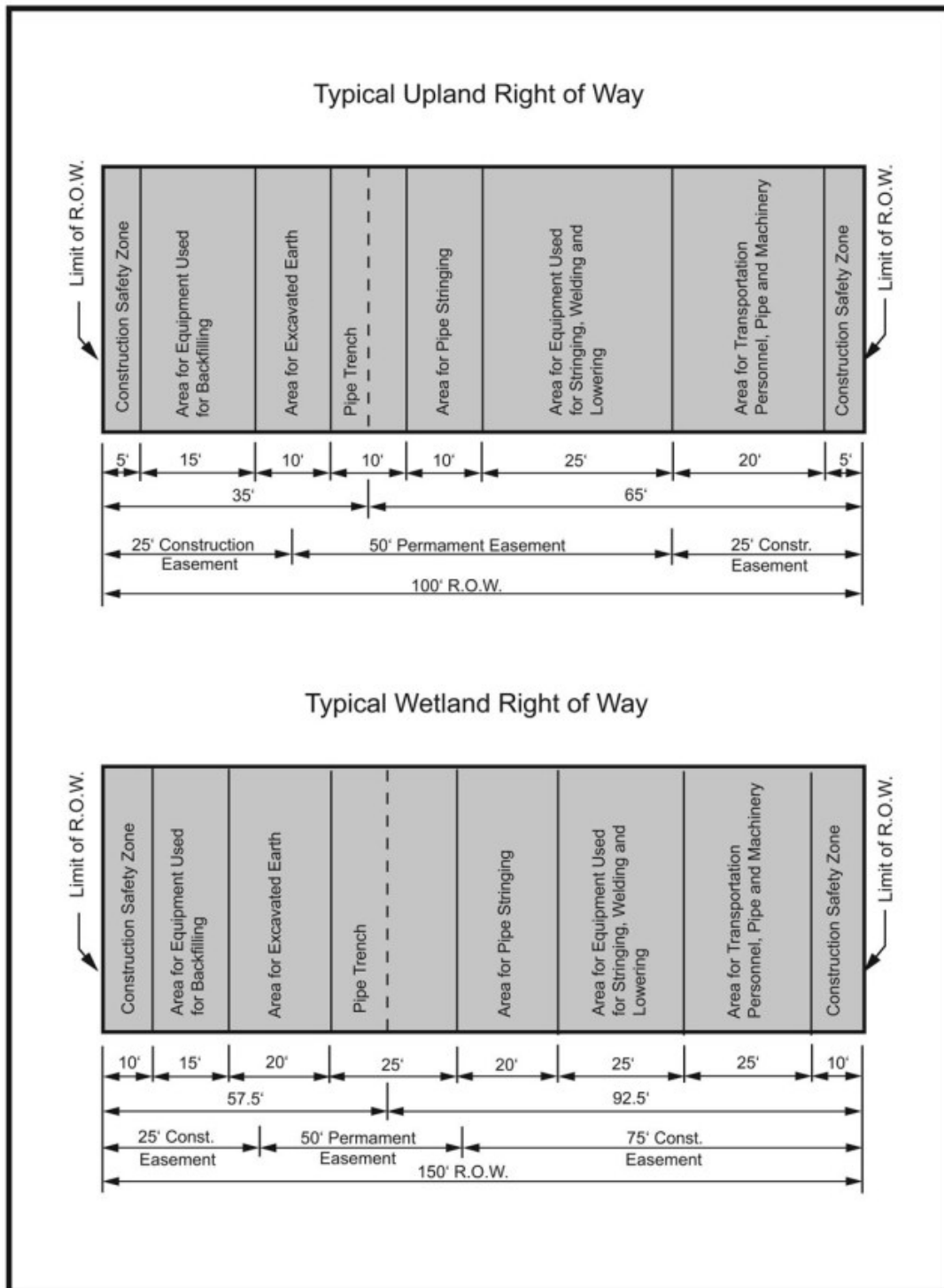
In offshore water, excavation of the pipeline ROW would occur after the pipeline was laid. First, the pipeline would be assembled sequentially on a pipelay barge with a conveyor system, and then it would be pushed into the Gulf where it would be allowed to descend to the sea floor. A dredging sled, mounted on the stern of the trenching barge, then would be lowered to the ocean floor and positioned over the pipe. Hydraulic jets on the sled would displace the material around the pipe. The pipeline would then lie in the trench previously occupied by the displaced bottom material. Depending on the area's environmental sensitivity, the resulting suspended bottom material would dissipate in the Gulf water or be collected and disposed of in **spoils** areas.

Pipeline construction would require both construction **easements** and permanent easements. The width of the easements would vary with the type of terrain the pipeline crosses and other site characteristics. Table 2.3.9-1 lists the typical easement width requirements for pipelines. Figure 2.3.9-1 shows the typical layout of a pipeline easement in both uplands and wetlands. Chapter 3 uses these easement assumptions to calculate the acreages affected by pipeline construction.

An **easement** is a right held by one party to make specific, limited use of land owned by another party. An easement is granted by the owner of the property for the convenience or ease of the party using the property. Common easements include the right to pass across the property or the right to construct a pipeline under the land or a power line over the land.

**Table 2.3.9-1: Typical Widths of Pipeline Easements**

Land Type	Construction Easement	Permanent Easement	Total Easement
<b>Single Pipeline</b>			
Uplands	50 feet (15 meters)	50 feet (15 meters)	100 feet (30 meters)
Wetlands	100 feet (30 meters)	50 feet (15 meters)	150 feet (46 meters)
Water	100 feet (30 meters)	50 feet (15 meters)	150 feet (46 meters)
<b>Multiple Pipelines</b>			
Uplands	120 feet (37 meters)	50 feet (15 meters)	170 feet (52 meters)
Wetlands	150 feet (46 meters)	100 feet (30 meters)	250 feet (76 meters)
Water	150 feet (46 meters)	100 feet (30 meters)	250 feet (76 meters)

**Figure 2.3.9-1: Uplands and Wetlands Pipeline ROW Requirements for a Single Pipeline**Figure 2-6 v2  
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### **2.3.10 Operations and Maintenance**

This section discusses typical operation and maintenance activities for SPR sites and pipeline systems.

#### ***Site Operations and Maintenance***

The main activities at an SPR site would include oil drawdown and fill and routine daily operations such as inspecting equipment, preparing log sheets, documenting data for equipment performance evaluation, reporting safety hazards, making environmental checks, performing laboratory work, and conducting maintenance activities. As necessary, a site would be sprayed with herbicides (e.g., around the fenceline) and pesticides (e.g., for fire ants and mosquitoes). Section 3.2 identifies these and other chemicals commonly used at an SPR site. An SPR facility would employ approximately 75 to 120 people onsite, depending on the site's final storage capacity. Operations and security personnel would be onsite 24 hours a day.

DOE would monitor cavern structural integrity daily by measuring pressure trends. DOE would test completed caverns for structural stability at least once every 5 years by using nitrogen well-leak tests as prescribed by methods acceptable to respective state regulators.

The central control room at an SPR site would remotely monitor many onsite activities and operations. Valves and other operating mechanisms along the oil pipeline would be adjusted from the control room. The control room operator also would detect any leaks in the brine pipeline and deviations in cavern pressure. An onsite data logger would collect data continuously about the condition of the facility. During oil movement, flow and pressure would be monitored hourly by manually checking the conditions at the valves. The control room would be staffed 24 hours a day, 7 days a week by at least one shift leader. The shift leader would direct staff to monitor situations at distant locations as needed.

Maintenance activities at an SPR site typically would include the preventive and corrective maintenance of solution mining equipment including pumps, motors, valves, instruments, piping, and "workovers" (work programs performed on existing cavern wells) to reposition cavern strings.

Hazardous materials are used in the operation and maintenance of existing SPR sites and would be used at proposed new and expansion sites. Table 2.3.10-1 itemizes the types and quantities of hazardous materials typically stored at existing SPR sites.

Spills of hazardous materials from SPR sites are required to be reported under several Federal and state laws and regulations and SPR site operating procedures. Emergency response procedures for each SPR site address the requirements for reporting spills of hazardous materials to the SPR operations and maintenance contractor, DOE, and appropriate Federal, state and/or local regulatory agencies.

Various local, state, and Federal requirements also govern the management of hazardous materials and responses to spills. For example, the Federal Clean Water Act and related state statutes and regulations require sites to develop and maintain a Spill Prevention, Control, and Countermeasures Plan, and the Pollution Prevention Act of 1990 requires sites to develop and maintain pollution prevention plans and stormwater pollution prevention plans. Each proposed new SPR site would be required to develop and implement a Spill Prevention, Control, and Countermeasures Plan, and each expansion site would be required to update the site plan to incorporate the additional storage infrastructure and operations. Other site-specific plans that would be part of each SPR site's environmental program include Emergency Response Procedures with spill reporting procedures and a Site Environmental Monitoring Plan.

**Table 2.3.10-1: Typical Quantities of Hazardous Materials Stored at Existing SPR Sites**

<b>Material (Use)</b>	<b>Typical Location</b>	<b>Maximum Daily Amount Stored Onsite (pounds)</b>
Ammonium bisulfite solution (water treatment chemical)	Brine pad, raw water injection pad, equipment pad	10,000–99,999
Bromotrifluoromethane (refrigerant)	Various	1,000–9,999
Diesel fuel #2 (emergency power generation, motor fuel)	Emergency generator fuel tanks, property tank	10,000–99,999
FC-203CE Lightwater Brand AFFF (fire protection chemical)	Foam storage building	10,000–99,999
FC-203CF Lightwater Brand AFFF (fire protection chemical)	Foam deluge building	10,000–99,000
FC-600 Lightwater Brand ATC/AFFF (fire protection chemical)	Foam storage building	10,000–99,999
Ansulite 3% AFFF AFC-3A (fire protection chemical)	Firetrucks, foam storage building	10,000–99,999
Flogard POT805 (water treatment chemical)	Potable water building	100–999
Gasoline (motor fuel)	Property tank	10,000–99,999
Herbicides, such as Monsanto Rodeo and Red River 90 Spray Adjuvant (grounds maintenance)	Flammable storage building	1,000–9,999
Motor oil (motor lubricant)	Flammable storage building, equipment areas	1,000–9,999
Oil Base Sweep EZ Floor Sweep (property maintenance)	Maintenance building	100–999
Paints (property maintenance)	Flammable storage building	1,000–9,999
Silica, crystalline quartz	Maintenance building	10,000–99,999
Simple Green (cleaner, degreaser, deodorizer)	Maintenance building	100–999
Sodium hypochlorite solution (water treatment)	Potable water building	100–999

To convert pounds to kilograms, multiply by 0.4536

Source: *Site Environmental Report for Calendar Year 2003*. DOE 2004f. Tables 2-2 through 2-7.

Each SPR site would also implement an environmental training program to ensure that applicable personnel are aware of the SPR Environmental Management System and environmental laws and regulations, and are trained in oil and hazardous material spill prevention and the safe handling of hazardous waste. In the event of a hazardous material release, trained emergency response personnel at the SPR site would respond to control and minimize spill impact.

Local, state, and Federal fire protection standards and guidelines applicable to existing SPR sites are identified in the 2003 *Site Environmental Report Appendix A: Strategic Petroleum Reserve - DM Environmental Standards* (DOE 2004f). These standards and guidelines would also apply to proposed new SPR sites in Texas and Louisiana, and similar state and local standards and guidelines would apply to proposed new SPR sites in Mississippi.

Fire protection systems at existing SPR sites include firewater storage tanks and ponds, firewater pumps, and fire trucks. For example, firewater is supplied to the Bayou Choctaw and Big Hill sites through the RWI system and to the West Hackberry site through a deepwater well at a design rate of 375 gallons (1,400 liters) per minute. A secondary water supply is provided to the West Hackberry site from the Hackberry community water works at a rate of no more than 500 gallons (1,900 liters) per minute. All of these systems are equipped with a series of primary pumps, backup pumps, and firewater tanks. Each of the existing sites also has automatic and manually activated aqueous film forming foam systems for fire protection; sprinkler systems to protect control centers, maintenance buildings, foam buildings, and other buildings; a fire truck with pumps capable of using water or water/foam; and portable, trailer-mounted, foam-water pumps and portable fire extinguishers on wheels.

The SPR has adopted the National Interagency Incident Management System, the response management system required by the National Oil and Hazardous Substances Pollution Contingency Plan. Each existing SPR site has a group of well-trained Emergency Response Team personnel who can respond to emergencies such as spills and fires. These personnel and New Orleans response management personnel have been trained in the unified Incident Command System and a team of selected New Orleans response personnel is available to support extended site emergency operations when needed.

All of the fire protection systems at the existing SPR sites would be available for use if those sites are selected for expansion. Likewise, each of the proposed new sites would be equipped with fire protection systems that are functionally equivalent to those described above.

### ***Pipeline Operations and Maintenance***

DOE would inspect pipeline ROWs regularly for adjacent surface conditions and indications of leaks, **geophysical** activity, oil theft, sabotage, construction by others, and other factors affecting pipeline safety and operation. Weekly aerial patrols would monitor all general conditions affecting the ROW. Land and water patrols would investigate problems observed from the aerial patrols.

Nuisance vegetation along the pipeline ROW would be mowed regularly. In addition, defoliants would be used as needed to destroy additional vegetation that hinders pipeline operation and maintenance. Erosive conditions would be prevented and controlled by maintaining grass covers and constructing or maintaining terraces, **plugs**, and **bulkheads**.

**Bulkheads** are retaining walls designed to hold or prevent the sliding of soil caused by erosion and wave action.

Other maintenance would include painting exposed portions of the pipeline and **pigging** the pipeline. Pigging monitors interior conditions of pipelines and ensures that efficient flow conditions are maintained. RWI pipelines would be cleaned periodically by scraper or brush **pig** operations. Use of “smart pigs” with ultrasonic detection and magnetometrics could be used as appropriate. **Caliper pigging** would be performed periodically to ensure pipeline integrity.

In **pigging** operations, inspection and cleaning devices called “pigs” are sent through pipelines to check the condition of pipelines and clean them. Caliper pigging is used to determine the thickness of pipeline wells.

### **2.3.11 Decommissioning**

Section 159(f) of the Energy Policy and Conservation Act authorizes DOE to use, lease, maintain, sell or otherwise dispose of land or interests in land, or of storage and related facilities acquired under the SPR program. DOE may decommission and dispose of an SPR storage facility if it could no longer effectively continue its program mission. This could arise for a variety of reasons: if the SPR storage facility was no

longer able to maintain critical physical systems, retain geological integrity, support the SPR program mission economically, or remain in compliance with state, Federal, and DOE environmental, safety, and health requirements. In addition, decommissioning could take place if the SPR storage program were to be terminated by Congress at some future date.

Decommissioning of an SPR storage facility has been undertaken twice in the past. During the early 1990s, DOE disposed of the Sulphur Mines SPR storage facility, an unneeded SPR site in Louisiana, with replacement capacity to be developed by the then on-going enlargement of the caverns at Bayou Choctaw and Big Hill storage facilities. The Sulphur Mines SPR storage facility was sold to an outside commercial user. Pursuant to NEPA, DOE prepared an Environmental Assessment to assess the potential environmental consequences of decommissioning the Sulphur Mines storage facility (DOE 1990b) which resulted in the issuance of a Finding of No Significant Impact. In late 1999, the Weeks Island SPR site, Iberia Parish, Louisiana storage facility was successfully decommissioned by DOE. The Weeks Island Mine had served as an SPR storage facility from its conversion from a commercial room and pillar salt mine in 1977. Following oil fill in 1980-1982, it stored about 73 MMB of crude oil until late 1995, at which time DOE submitted a plan for decommissioning and initiated oil drawdown procedures. DOE recognized that groundwater was leaking into the stored oil chambers by means of a rapidly growing sinkhole that had developed over the southern periphery of the mine and that the integrity of the mine could no longer be assured and it was unsuited for continued crude oil storage. Pursuant to NEPA, DOE prepared an Environmental Assessment to assess the potential environmental consequences of decommission of the Weeks Island SPR site (DOE 1995a) which resulted in the issuance of a Finding of No Significant Impact.

Decommissioning activities at an SPR facility and associated potential environmental impacts would depend on the future use of the facility. If the site were destined for continued use as an oil storage facility, activities might consist of little more than a change in ownership. Oil in storage could be included in the sale or withdrawn and moved to another SPR site. If, however, DOE were to close the facility entirely, extensive closure activities could be necessary. Under this scenario, crude oil would be removed from the caverns by displacement with water, which eventually would form brine in the caverns. Cavern wells would be plugged with concrete to prevent brine leakage through the casing. All above ground facilities, such as buildings, pumps, site electrical substations, and RWI structures would be demolished or removed from the site. Brine ponds would be closed. Crude oil pipelines would be emptied, cleaned, and capped. Underground pipelines likely would be left in place. Pipeline water crossings would be abandoned, but pipelines crossing waterways would be modified to minimize the chance that they could become future hazards to navigation. Such actions might include filling the pipelines with cement or filling them with a substance to encourage oxidation and decomposition. Electric power lines would be removed. Finally, the site would be revegetated with native species.

At this time DOE has no known or planned timetable for such post-operational decommission activities at existing expansion sites or proposed new sites, and future decommission remains distant. Unlike the Weeks SPR storage facility, which was a converted salt pillar mine, only solution mined caverns specially constructed for crude oil storage are currently used at SPR facilities, and these caverns have intrinsic geological stability. Hence future decommissioning would likely occur as a currently unforecastable economic or strategic decision. Also, DOE has designed storage cavern construction to sustain a minimum of five cycles of drawdown and fill. DOE has determined, however, that 10 or more cycles generally can be sustained under the current design standards. Also, in the four decades of SPR experience, relatively few complete cycles have occurred. Thus, in the reasonably foreseeable future, proposed new caverns are unlikely to be decommissioned due to completion of their useful life.

Because the ranges of possible decommissioning activities and associated environmental impacts is so broad, and these activities remain remote in time, no further discussion is included in this draft EIS. If

any future decommissioning of a SPR storage facility did become warranted, site-specific Environmental Assessments or EISs would then be undertaken as required under NEPA, and the potential environmental, socioeconomic, and other impacts to the SPR site would be evaluated.

## **2.4 POTENTIAL NEW SITES AND ASSOCIATED INFRASTRUCTURE**

This section describes the proposed action at each of the proposed sites. It describes the proposed new sites and associated infrastructure in alphabetical order and then the proposed expansion sites in alphabetical order. Table 2.4-1 presents key information for each of the proposed alternatives.

Following are some important notes about the data shown in table 2.4-1:

- The number of acres listed for each storage site represents the area of the site plus the area of a 300-foot (91-meter) buffer zone around the site.
- Lengths of individual crude oil pipelines, electric power lines, and roads are shown separated by a + sign. The totals shown are an aggregate of these individual lengths.
- Values shown for new ROWs represent the total lengths of new ROWs that would be created for oil or brine pipelines, electric power lines, and roads. These ROWs often would be shared.
- Values shown for expanded or existing ROWs represent the total lengths of existing ROWs and existing ROWs that would be expanded, used for oil or brine pipelines, electric power lines, and roads. These ROWs often would be shared.
- Because they are included collectively in several of the alternatives, values for the expansion sites Bayou Choctaw, Big Hill, and West Hackberry are first listed separately and subsequently as a single aggregated total with the heading “3 Expansion Sites.”
- Similarly, when being included together in an alternative, values for the expansion sites Bayou Choctaw and Big Hill are first shown separately and subsequently as a single aggregated total with the heading “2 Expansion Sites.”

### **2.4.1 Bruinsburg Storage Site**

The Bruinsburg salt dome is located in Claiborne County, MS, 10 miles (16 kilometers) west of the town of Port Gibson (see figure 2.4.1-1) and 40 miles (64 kilometers) southwest of the town of Vicksburg. This proposed new site would consist of 16 new caverns with a combined oil storage capacity of up to 160 MMBD. The site encompasses a cypress swamp, cotton fields, and an overlooking bluff. The maximum drawdown rate would be 1.0 MMBD. A proposed co-development of Clovelly and Bruinsburg is found in section 2.4.4.

The Bruinsburg site would encompass approximately 266 acres (108 hectares) that includes an active cotton farm and forested areas. Developing this new SPR facility would require constructing 16 new, 10-MMB-capacity caverns, as illustrated in figure 2.4.1-2. In addition, a water pumping system for cavern solution mining and oil drawdown; a brine settling and disposal system for cavern solution mining and oil fill; an oil pumping and measurement system for oil storage and distribution; administration, control, and maintenance buildings; and fire protection and physical security systems would be built. The location of the new caverns would be within the 100-year floodplain, whereas the facilities would be located outside of the 100-year floodplain on a bluff overlooking the caverns. A site access road from

Table 2.4-1: Key Details of the Alternatives

Alternative	Increased Storage Capacity MMB	No. of Caverns	Storage Site and Buffer	Pipelines (Miles per Pipeline)			Power Lines	Roads	New ROWs <sup>b</sup>	Expanded Existing ROWs <sup>b</sup>	Other Facilities	
			Acres	Crude Oil	Water	Brine	Miles	Miles	Miles	Miles	Types	Acres
<b>Bruinsburg</b>	160	16	365	39 and 109	4	14	11, 1, 4, 7, and 6	1 and 11	131	58	IW, T, RWI	215
3 Expansion sites	115	10 and 3 <sup>a</sup>	287	23	0	2	0	2	2	24	IW pads	96
<i>Bayou Choctaw</i>	20	2	0	0	0	1	0	1	1	0	<i>IW pads</i>	96
<i>Big Hill</i>	80	8	206	23	0	1	0	0	0	24	<i>None</i>	0
<i>West Hackberry</i>	15	3 <sup>a</sup>	81	0	0	0	0	1	1	0	<i>None</i>	0
Total	275	29	652	171	4	16	29	15	133	82		311
<b>Bruinsburg</b>	160	16	365	39 and 109	4	14	11, 1, 4, 7, and 6	1 and 11	131	58	IW, T, RWI	215
2 Expansion sites	116	8 and 2	206	23	0	2	0	1	1	24	IW pads	96
<i>Bayou Choctaw</i>	20	2	0	0	0	1	0	1	1	0	<i>IW pads</i>	96
<i>Big Hill</i>	96	8	206	23	0	1	0	0	0	24	<i>None</i>	0
Total	276	26	571	171	4	16	29	13	132	82		311
<b>Chacahoula</b>	160	16	320	21 and 54	18	41 and 17 <sup>c</sup>	10, 15, and 5	4	64	86	RWI	1
3 Expansion sites	115	10 and 3 <sup>a</sup>	287	23	0	2	0	2	2	24	IW, T, RWI	96
Total	275	29	607	98	18	60	30	6	66	110		97
<b>Chacahoula</b>	160	16	440	21 and 54	18	41 and 17 <sup>c</sup>	10, 15, and 5	4	64	86	RWI	1
2 Expansion sites	116	8 and 2	206	23	0	2	0	1	1	24	IW Pads	96
Total	276	26	646	98	18	60	30	5	65	101		97
<b>Clovelly</b>	120	16	0	0	0	0	0	0	0	0	RWI/Off Site Fac	5
3 Expansion sites	153	11 and 4 <sup>a</sup>	289	23	0	2	0	2	2	24		96
<i>Bayou Choctaw</i>	30	2 and 1 <sup>a</sup>	2	0	0	1	0	1	1	0	<i>IW Pads</i>	96
<i>Big Hill</i>	108	9	206	23	0	1	0	0	0	24	<i>None</i>	0
<i>West Hackberry</i>	15	3 <sup>a</sup>	81	0	0	0	0	1	1	0	<i>None</i>	0
Total	273	31	289	23	0	2	0	2	2	24		101
<b>Clovelly 80 MMB-Bruinsburg 80 MMB</b>	160	20	254	86	4	8	11, 1, 4, 7, and 6	6	65	40	IW, T, RWI. Off Site Fac	113
<i>Bruinsburg (80)</i>	80	8	254	32 and 54	4	8	11, 1, 4, 7, and 6	1 and 5	65	40	IW, T, RWI	108
<i>Clovelly (80)</i>	80	12	0	0	0	0	0	0	0	0	<i>RWI/Off Site Fac</i>	5
3 Expansion sites	115	10 and 3 <sup>a</sup>	287	23	0	2	0	2	2	24	IW Pads	96
<i>Bayou Choctaw</i>	20	2	0	0	0	1	0	1	1	0	<i>IW pads</i>	96

Table 2.4-1: Key Details of the Alternatives

Alternative	Increased Storage Capacity MMB	No. of Caverns	Storage Site and Buffer Acres	Pipelines (Miles per Pipeline)			Power Lines Miles	Roads Miles	New ROWs <sup>b</sup> Miles	Expanded Existing ROWs <sup>b</sup> Miles	Other Facilities	
				Crude Oil	Water	Brine					Types	Acres
<i>Big Hill</i>	80	8	206	23	0	1	0	0	0	24	None	0
<i>West Hackberry</i>	15	3 <sup>a</sup>	81	0	0	0	0	1	1	0	None	0
Total	275	33	541	109	4	10	29	8	67	64		209
<b>Clovelly 80 MMB-Bruinsburg 80 MMB</b>	160	20	254	86	4	8	11, 1, 4, 7, and 6	6	65	40	IW, T, RWI	113
2 Expansion sites	116	8 and 2	206	23	0	2	0	1	1	24	IW Pads	96
<i>Bayou Choctaw</i>	20	2	0	0	0	1	0	1	1	0	<i>IW pads</i>	96
<i>Big Hill</i>	96	8	206	23	0	1	0	0	0	24	None	0
Total	276	26	460	109	4	10	29	7	66	64		209
<b>Clovelly 90 MMB-Bruinsburg 80 MMB</b>	170	20	254	86	4	8	11, 1, 4, 7, and 6	6	65	40	IW, T, RWI. Off Site Fac	113
<i>Bruinsburg (80)</i>	80	8	254	32 and 54	4	8	11, 1, 4, 7, and 6	1 and 5	65	40	IW, T, RWI	108
<i>Clovelly (90)</i>	90	12	0	0	0	0	0	0	0	0	<i>RWI/Off Site Fac</i>	5
3 Expansion sites	117	8 and 3 <sup>a</sup>	287	23	0	2	0	2	2	24	IW pads	96
<i>Bayou Choctaw</i>	20	2	0	0	0	1	0	1	1	0	<i>IW pads</i>	96
<i>Big Hill</i>	72	6	206	23	0	1	0	0	0	24	None	0
<i>West Hackberry</i>	15	3 <sup>a</sup>	81	0	0	0	0	1	1	0	None	0
Total	277	31	541	109	4	10	29	8	67	64		209
<b>Clovelly 90 MMB-Bruinsburg 80 MMB</b>	170	20	254	86	4	8	11, 1, 4, 7, and 6	6	65	40	IW, T, RWI	113
<i>Bruinsburg (80)</i>	80	8	254	32 and 54	4	8	11, 1, 4, 7, and 6	1 and 5	65	40	IW, T, RWI	108
<i>Clovelly (90)</i>	90	12	0	0	0	0	0	0	0	0	<i>RWI/Off Site Fac</i>	5

Table 2.4-1: Key Details of the Alternatives

Alternative	Increased Storage Capacity MMB	No. of Caverns	Storage Site and Buffer Acres	Pipelines (Miles per Pipeline)			Power Lines Miles	Roads Miles	New ROWs <sup>b</sup> Miles	Expanded Existing ROWs <sup>b</sup> Miles	Other Facilities	
				Crude Oil	Water	Brine					Types	Acres
2 Expansion sites	104	7 and 2	206	23	0	2	0	1	1	24	IW pads	96
<i>Bayou Choctaw</i>	20	2	0	0	0	1	0	1	1	0	<i>IW pads</i>	96
<i>Big Hill</i>	84	7	206	23	0	1	0	0	0	24	<i>None</i>	0
Total	274	29	460	109	4	10	29	7	66	64		209
<b>Richton</b>	160	16	387	88 and 116	10	87 and 13 <sup>c</sup>	11	2	144	72	T, RWI	131
3 Expansion sites	115	10 and 3 <sup>a</sup>	287	23	0	2	0	2	2	24	IW Pads	96
Total	275	29	634	227	10	102	11	4	146	96		227
<b>Richton</b>	160	16	347	88 and 116	10	87 and 13 <sup>c</sup>	11	2	144	72	T, RWI	131
2 Expansion sites	116	8 and 2	206	23	0	2	0	1	1	24	IW Pads	96
Total	276	26	553	227	10	102	11	3	145	96		227
<b>Stratton Ridge</b>	160	16	371	37 and 3	6	7 and 4 <sup>c</sup>	6	1	17	37	T, RWI	40
3 Expansion sites	115	10 and 3 <sup>a</sup>	287	23	0	2	0	2	2	24	IW Pads	96
Total	275	29	678	60	6	13	6	3	19	61		136
<b>Stratton Ridge</b>	160	16	371	37 and 3	6	7 and 4 <sup>c</sup>	6	1	17	37	T, RWI	40
2 Expansion sites	116	8 and 2	206	23	0	2	0	1	1	24	IW Pads	96
Total	276	26	577	60	6	13	6	2	18	61		136

1 mile = 1.61 kilometers; 1 acre = .0405 hectares

Notes:

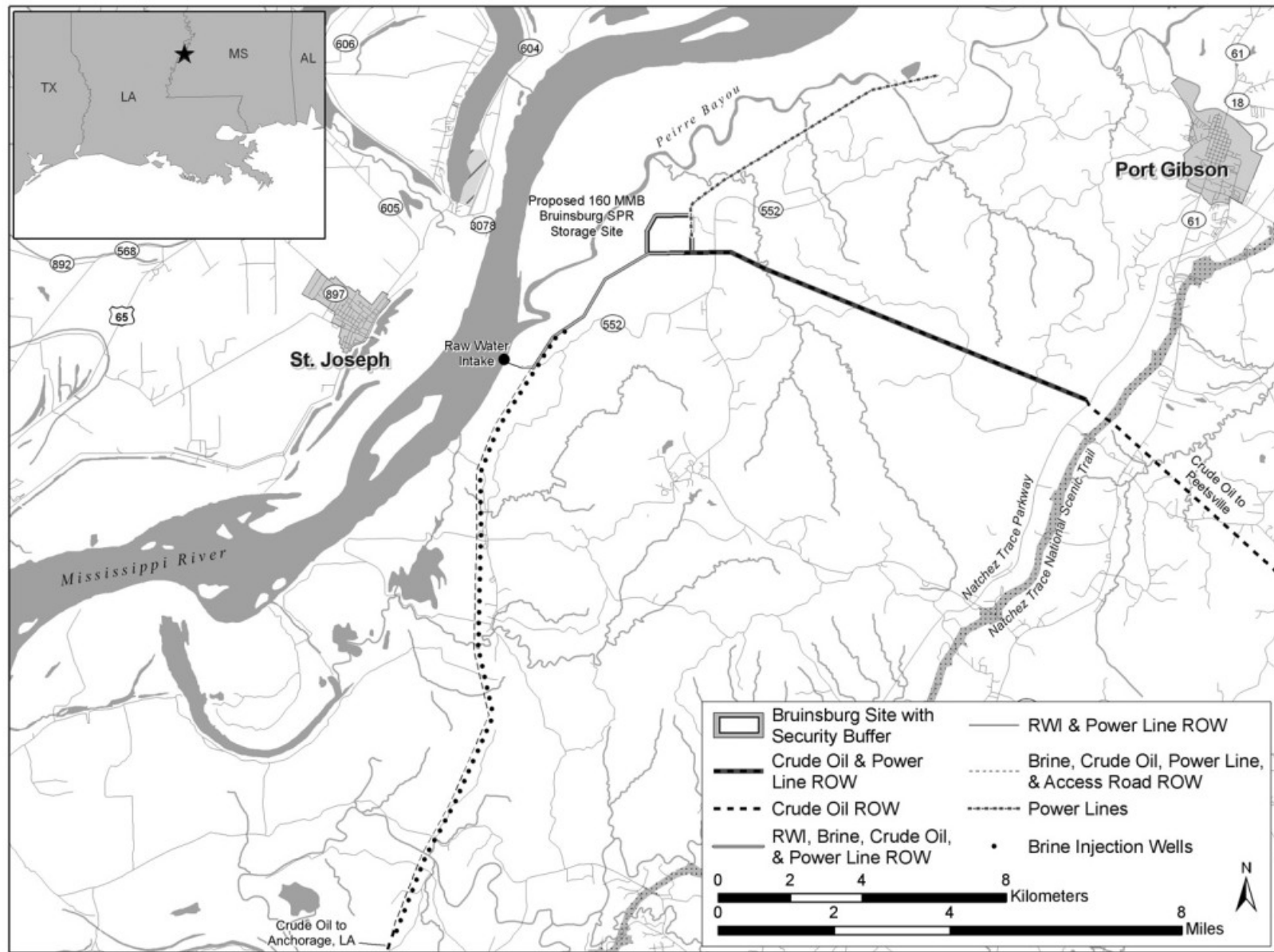
<sup>a</sup> Acquired cavern

<sup>b</sup> The sum of the mileage of individual pipelines, power lines, and roads for expanded existing ROWs and new ROWs may not add up to the total mileage of the individual pipelines for a site because some pipelines, roads, and power lines share the same corridor

<sup>c</sup> Offshore

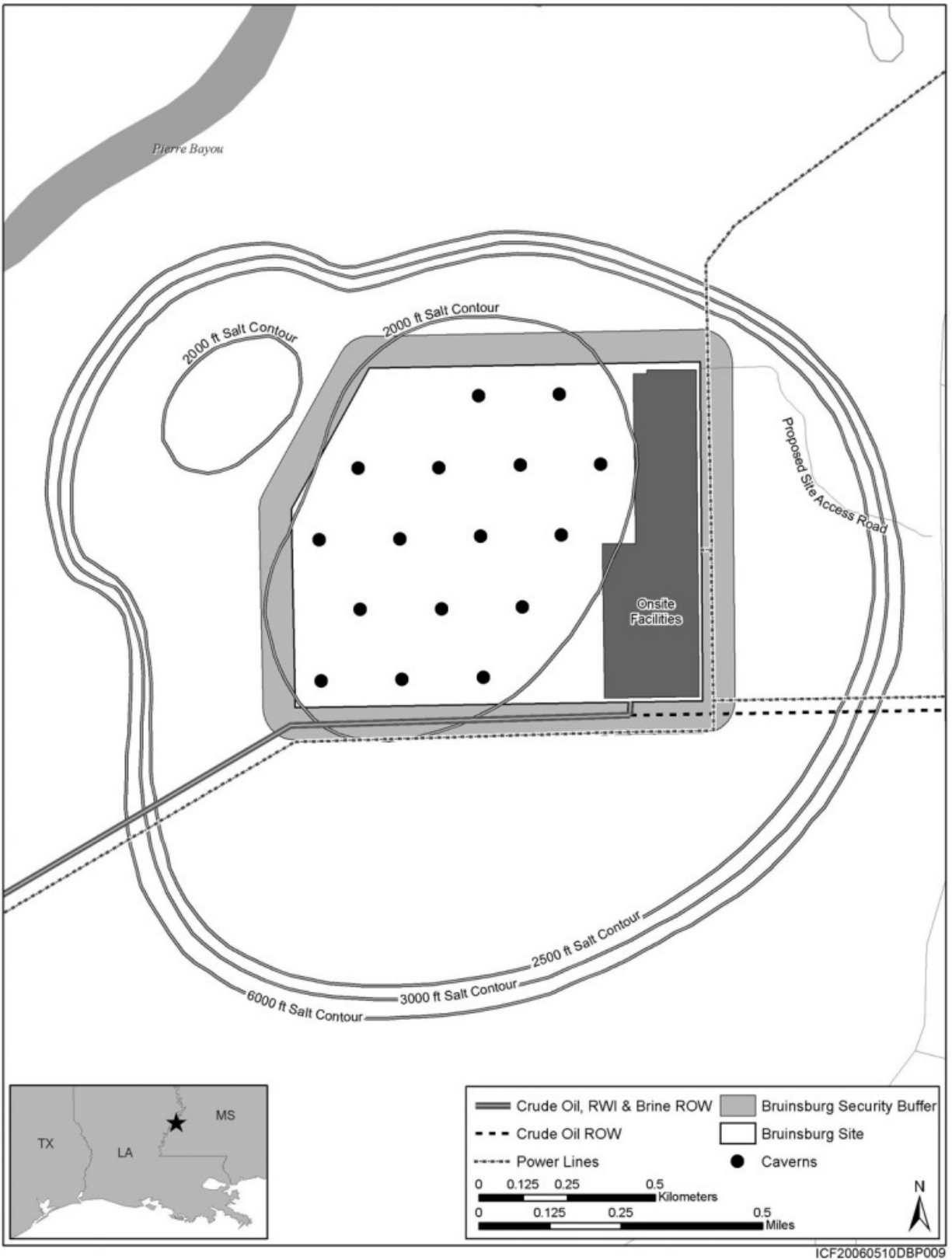
IW = injection wells; T = terminal(s)

Figure 2.4.1-1: Location of Proposed Bruinsburg Storage Site



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**Figure 2.4.1-2: Proposed Layout of Bruinsburg Storage Site**



Route 552 would be built, of which 1,200 feet (366 meters) would be new, and the remainder would be a refurbished road.

A security buffer surrounding the site would be created by clearing 99 acres (40 hectares) 300 feet (91 meters) beyond a security fenceline for line-of-sight surveillance. The security buffer area would be cleared of undergrowth, scrub, shrub, and any trees, and would be managed as an open area. To do so, DOE may purchase additional land or easements from owners of abutting lands.

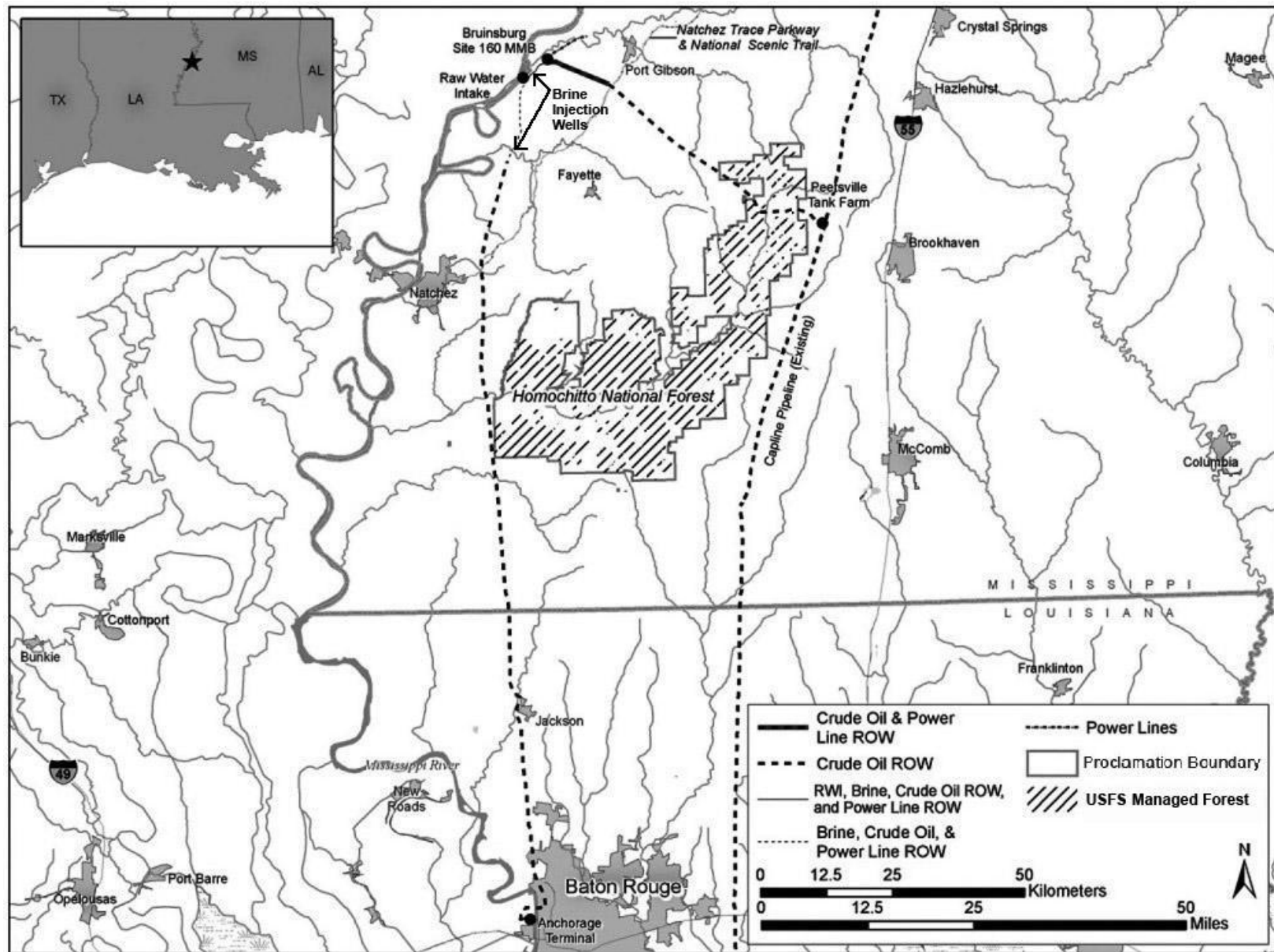
Raw water for solution mining at the Bruinsburg site would be drawn from the Mississippi River through a 42-inch (107-centimeter) pipeline that would run 4 miles (6.6 kilometers) south-southwest from the main site. The RWI pipeline is illustrated in figure 2.4.1-1. An RWI structure of 0.54 acres (0.22 hectares) on a construction footprint of 1.07 acres (0.43 hectares), which would be constructed at the point where the pipeline meets the Mississippi River, would house a set of 2,500-horsepower intake pumps. Another set of 2,500-horsepower RWI pumps with a system capacity of 1.2 MMBD would be installed at the Bruinsburg site. An existing road would be refurbished to provide access to the RWI.

Of the new proposed sites, Bruinsburg would be the only site to use injection wells as its method of brine disposal. A 48- to 16-inch (122- to 41-centimeter), 14-mile (22-kilometer), brine disposal pipeline would transport the brine into underground injection wells located along the proposed Baton Rouge crude oil pipeline ROW. Sixty brine disposal wells would be spaced at 1,000-foot (300-meter) intervals along the ROW, but only 40 wells would operate at any one time. Twenty wells would be on standby or down for routine maintenance. An area of 230 feet by 230 feet (70 meters by 70 meters) would be cleared and fenced for each brine disposal well. The brine settling and disposal system would have a maximum capacity of 1.2 MMBD. An 11-mile (18-kilometer) road also would be constructed along the proposed brine pipeline to facilitate brine well construction and maintenance activities.

Crude oil would be transported to and from the storage site through two pipelines, as illustrated in figure 2.4.1-3. The first is a 30-inch (76-centimeter), 39-mile (62-kilometer) pipeline to the Capline Pipeline pump station at Peetsville, MS and a new 1.6 MMB storage terminal/tank farm that would be built on a 65-acre (26-hectare) site there. The Peetsville 65-acre (26-hectare) site would contain four 0.4 MMB oil storage tanks, support facilities, and an electrical substation (see figure 2.4.1-4). Electrical power to the substation would be provided from the abutting Peetsville pump station. Figure 2.4.1-4 illustrates the proposed facilities at Peetsville. The oil pumping and measurement system for oil storage and distribution would have a drawdown capacity of 0.5 MMBD from the caverns to the tank farm and 1.0 MMBD to the Capline system. The second pipeline is a 36-inch (91-centimeter), 109-mile (176-kilometer) pipeline to a terminal/tank farm that would be built on a 75-acre (30-hectare) site at Anchorage, LA. A tank farm similar to the Peetsville tank farm would be built connected by a 0.2-mile (0.3-kilometer) pipeline to the Placid refinery and a 0.8-mile (1.3-kilometer) pipeline to the nearby Exxon Mobil facility (see figure 2.4.1-5). The pipeline to the Placid refinery would provide DOE access to the Placid refinery marine terminal on the Mississippi River. Figure 2.4.1-5 illustrates the proposed facilities at Anchorage.

Two 138-kilovolt power lines would be built to a substation at the site, a 5-mile (9-kilometer) line to Vicksburg Entergy's Grand Gulf substation, and a 7-mile (12-kilometer) line to the Port Gibson west side substation, as illustrated in figure 2.4.1-1. Each power line would require a 100-foot (30-meter) ROW. Two parallel 34.5-kilovolt power lines from the site substation to the RWI would be constructed along the 4-mile (6.5-kilometer) corridor of the raw water pipeline, as illustrated in figure 2.4.1-1. The ROW would be 60 feet (18 meters) wide. Two parallel 7.5 kilovolt power lines would be constructed from the RWI to run 0.6 miles (1.0 kilometers) east to the brine disposal pipeline and then along the 11 miles (18 kilometers) of the brine disposal pipeline to power the injection wells.

Figure 2.4.1-3: Proposed Pipelines for Bruinsburg 160 MMB Storage Site



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Figure 2.4.1-4: Proposed Layout of Peetsville Tank Farm

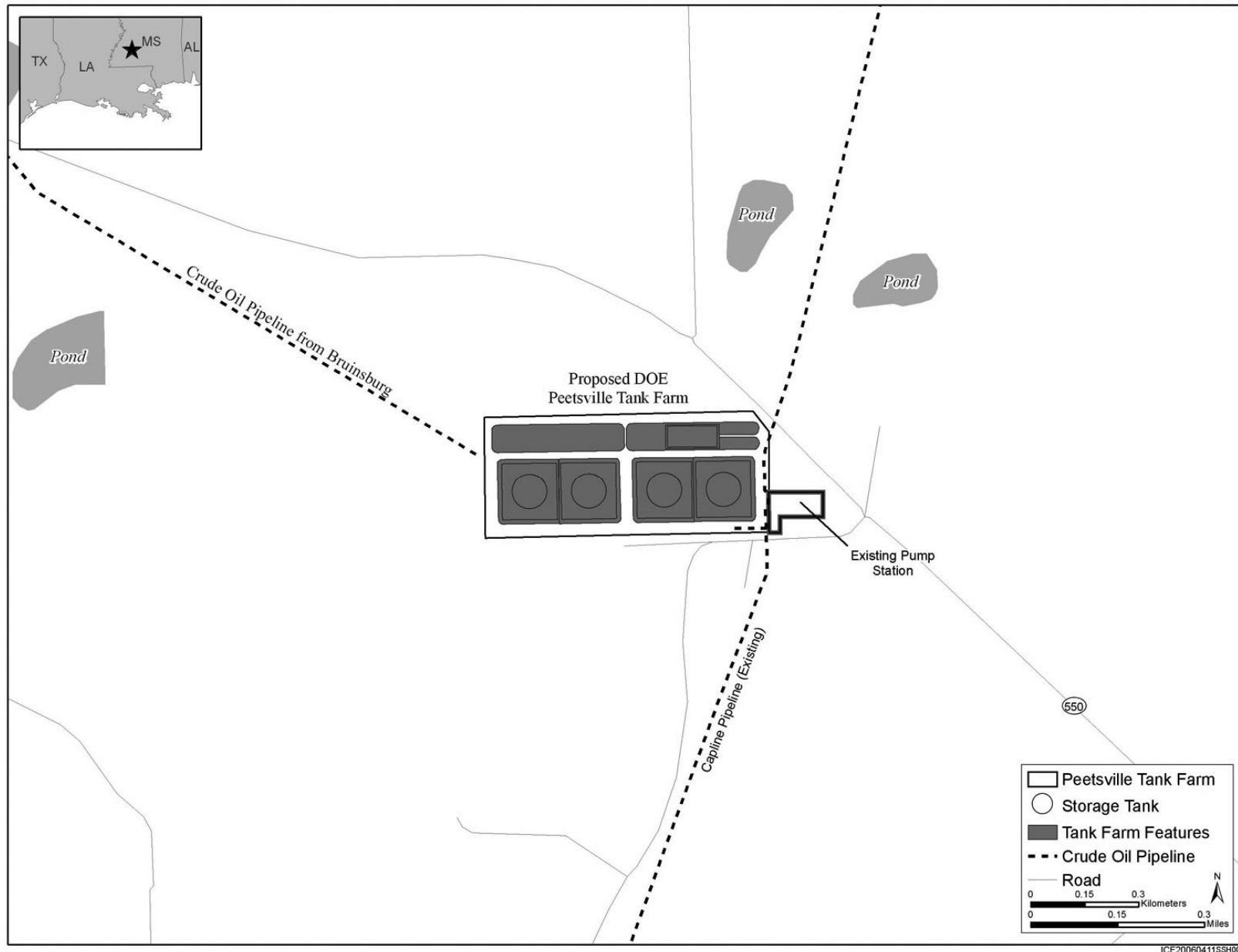
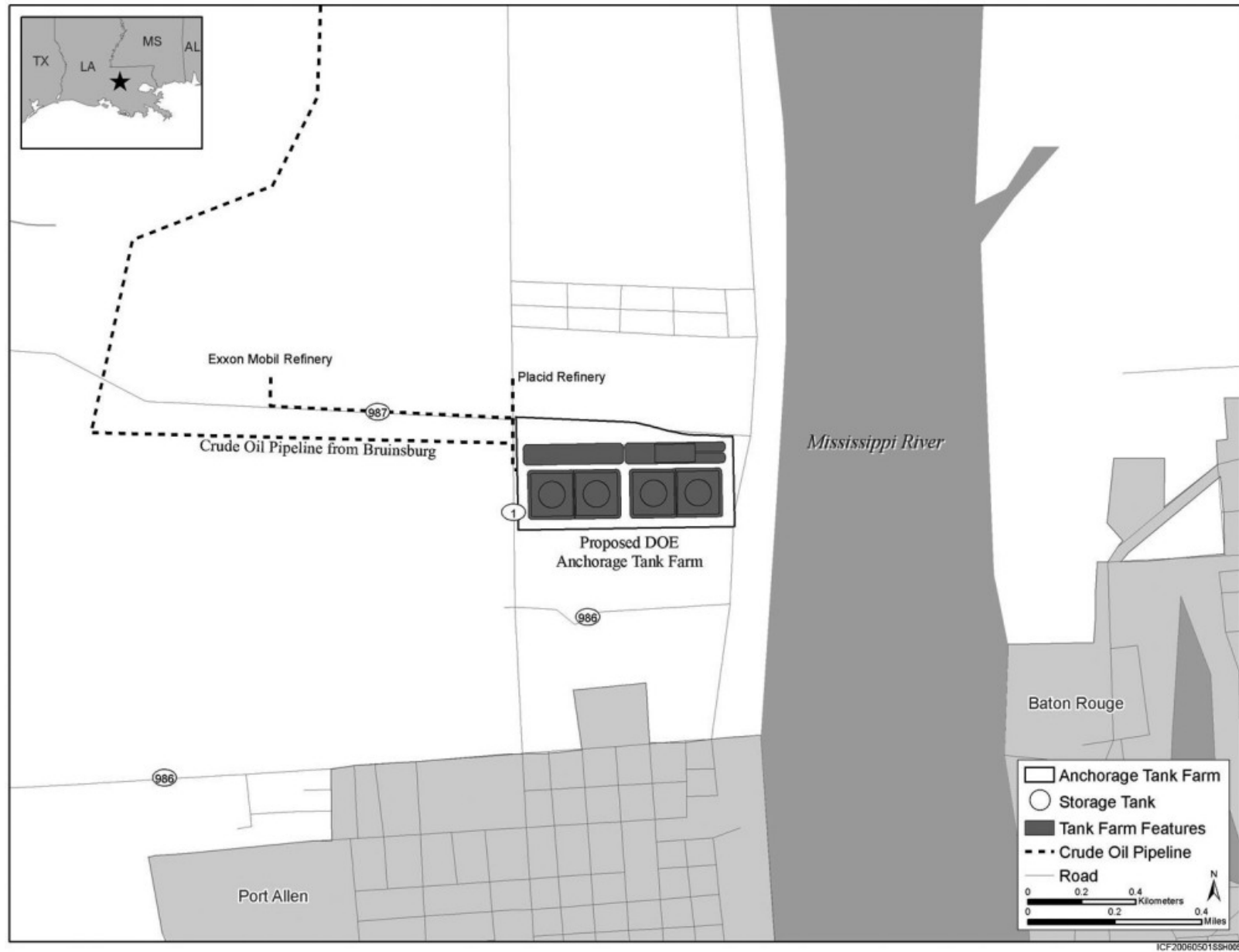


Figure 2.4.1-5: Proposed Layout of Anchorage Tank Farm



### 2.4.2 Chacahoula Storage Site

The Chacahoula salt dome site is located 40 miles (64 kilometers) north of the Gulf of Mexico, in northwest Lafourche Parish, southwest of Thibodaux, LA (see figure 2.4.2-1). This proposed new site would consist of 16 new caverns with a total capacity of 160 MMB. The maximum drawdown rate would be 1.2 MMBD.

The Chacahoula site, which would encompass approximately 227 acres (92 hectares), lies largely under water in wetlands. A security fence and road would be built 45 feet (14 meters) inside the property line on top of a **berm**. A security buffer zone would be cleared extending 300 feet (91 meters) from the fence and would comprise an area of approximately 93 acres (38 hectares). The land within the property line would be fully cleared in order to improve visibility and line-of-sight. The security buffer area would be cleared of any undergrowth, scrub, and any trees, and would be managed as an open area.

The area is largely undeveloped except for three brine caverns that have been developed by the Texas Brine Company in the south-central part of the 1,700-acre (690-hectare) Chacahoula salt dome and gas drillings on the south and northeast sides of the dome. The SPR storage site also would require constructing 16 new, 10-MMB capacity caverns, 8 raw water injection pumps, 4 brine injection pumps, 3 oil injection pumps, and numerous onsite buildings. Within the Chacahoula site, approximately 120 acres (49 hectares) would be filled in for the onsite facilities, cavern pads, and security fence and roads. The remaining area would be managed as an open water or emergent wetland. The wetlands between well pads would not be filled. Wetland areas within the site would remain interconnected with those outside the site via culverts. Infrastructure such as buildings and disposal ponds would require clearing and filling. As illustrated in figure 2.4.2-2, the caverns would be arranged in four rows of four caverns each in the western portion of the salt dome. At the storage site, DOE would construct a pig launcher and receiver for the pipeline, cavern oil distribution piping, and three 1,750-horsepower oil injection pumps. In addition, a crude oil storage tank may be built to store oil for use during cavern solution mining and maintenance operations. A 1.5 mile (2.4 kilometer) access road would be constructed from the site to Route 309. Construction on the site also would include buildings, security systems, and other surface features that are described in section 2.3.5.

The raw water used for cavern solution mining and drawdown would be obtained using four 2,500-horsepower pumps from a new RWI system on the Intracoastal Waterway (ICW) approximately 10 miles (16 kilometers) south of the project site. The new RWI structure of 0.54 acres (0.22 hectares), on a construction footprint of 1.07 acres (0.43 hectares), would be connected to the storage site through a 42-inch (107-centimeter), 10-mile (16-kilometer) raw water pipeline. The majority of the RWI pipeline would parallel the proposed brine disposal pipeline. A 2.4 mile (4 kilometer) access road would be constructed from the RWI to highway 90. A map of the pipeline routes appear in figure 2.4.2-3. An onsite water distribution system would carry the water to eight 3,500-horsepower raw water injection pumps.

A new brine disposal system also would be constructed. Solution mining of the storage caverns would generate brine at a maximum rate of 1.2 MMBD. Brine would be disposed of through a 58-mile (93-kilometer), 48-inch (122-centimeter), pipeline to a diffuser offshore in the Gulf of Mexico (see figure 2.4.2-3), coordinates 28°56'1"N and 91°4'56"W. During oil fill, brine would be generated at a maximum rate of 225 MBD. The proposed pipeline would run approximately 17 miles (28 kilometers) offshore to a depth of 30 feet (9 meters). The ROW would consist of a 150-foot (46-meter) wide construction and a 50-foot (15-meter) wide permanent easement. Brine collection piping from each cavern, a brine pond system to remove any anhydrites and residual oil, and five new 1,000-horsepower brine booster pumps would be constructed onsite to complete the brine disposal system. Seven new 2,500-horsepower injection pumps also would be used to pump raw water into the caverns during oil drawdown.

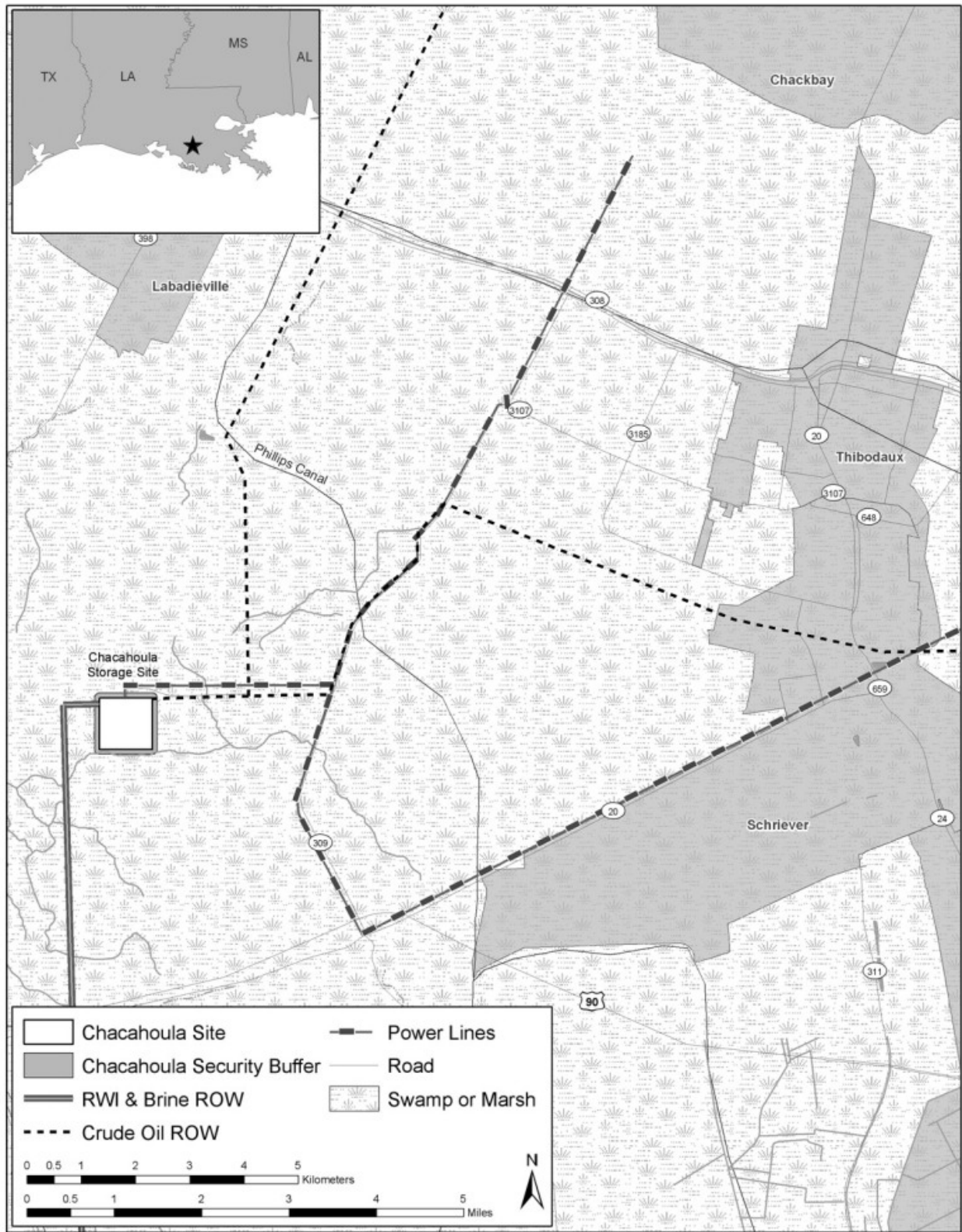
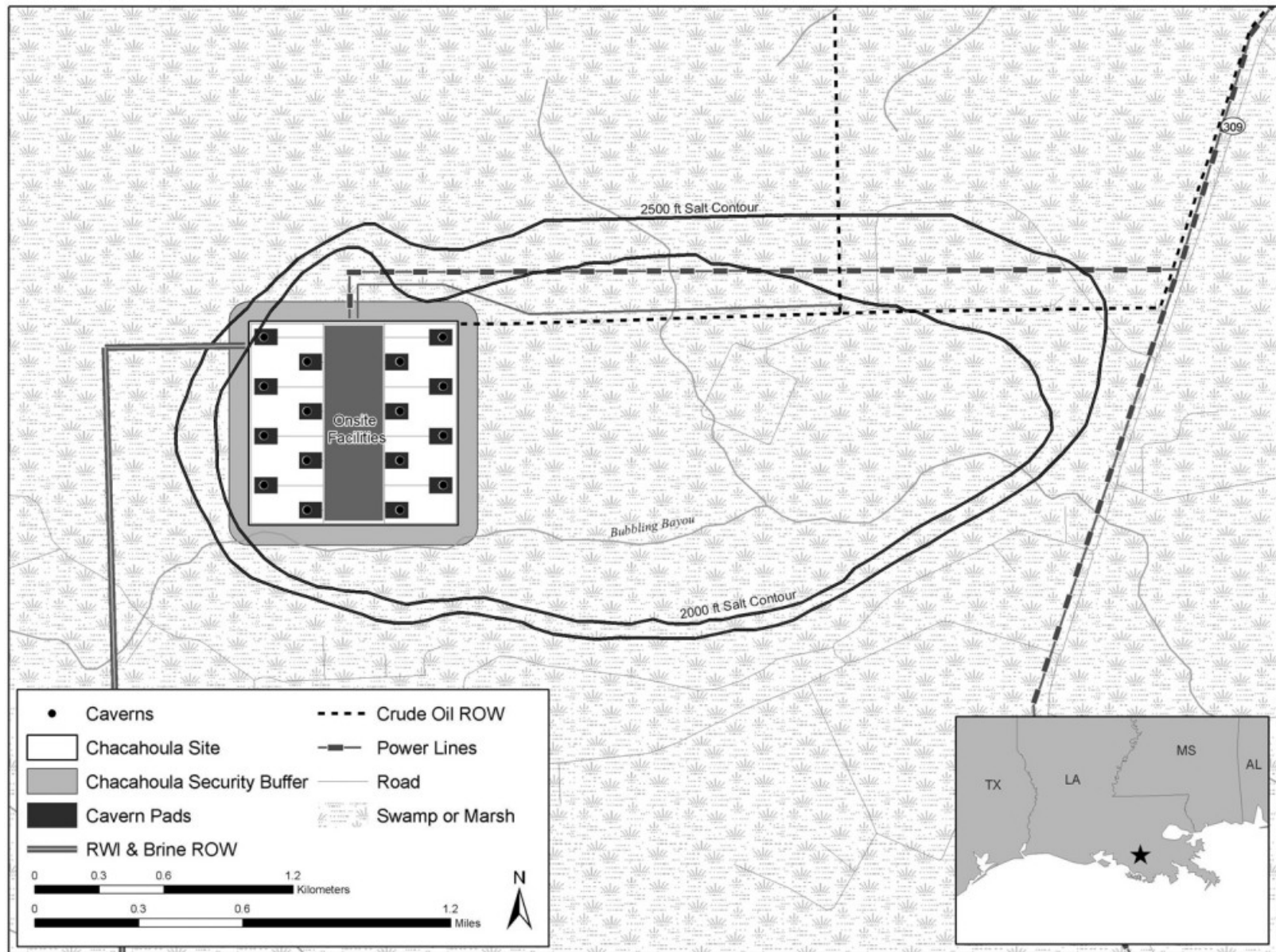
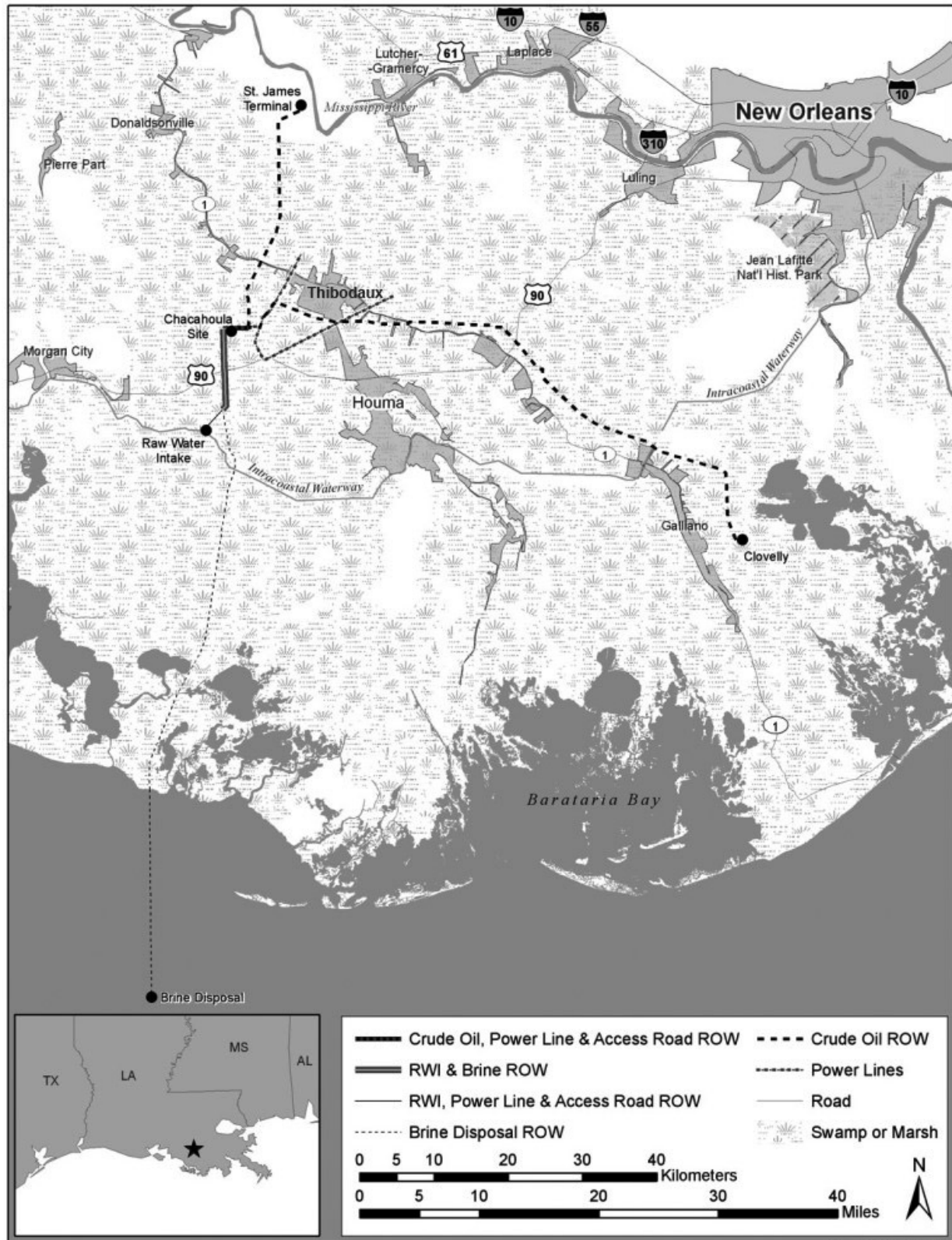
**Figure 2.4.2-1: Location of Proposed Chacahoula Storage Site**

Figure 2.4.2-2: Proposed Layout of Chacahoula Storage Site



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Figure 2.4.2-3: Proposed Pipelines for Chacahoula Storage Site



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Crude oil would be transported to and from the storage site through a 21-mile (34-kilometer), 48-inch (122-centimeter) pipeline to the St. James terminal on the Mississippi River and a 54-mile (87-kilometer), 42-inch (107-centimeter) pipeline to the Louisiana Offshore Oil Port (LOOP) terminal at Clovelly. The pipeline to the terminal would parallel the existing crude oil pipeline that runs to the Capline terminal, and it would share the ROW with the RWI pipeline. The pipeline to LOOP would follow the existing Shell-Texaco pipeline ROW (see figure 2.4.2-3).

Two 230-kilovolt power lines would be built to a substation at the site, one 10-mile (15-kilometer) power line from the Thibodaux substation on the Entergy 230-kilovolt power line and an 18-mile (26-kilometer) power line from the Terrebonne substation on the Entergy 230-kilovolt power line, as illustrated in figure 2.4.2-1. Each power line would require a 100-foot (30-meter) ROW, except for the last 3 miles (4 kilometers) where the two lines would run west in parallel to the site substation and require a 200-foot (60-meter) ROW. Two parallel 115-kilovolt power lines from a connecting point on Entergy's 115-kilovolt, 5-mile (7-kilometer) power line approximately 5 miles (7 kilometers) north of the RWI would be constructed along the corridor of the raw water pipeline to the RWI. The ROW requirement would be 150 feet (46 meters).

### 2.4.3 Clovelly Storage Site

The Clovelly site would be located east of Galliano, LA, in Lafourche Parish at the site of the LOOP Clovelly dome storage facility, as shown in figure 2.4.3-1. Co-located with LOOP's existing storage caverns, DOE would construct sixteen 7.5-MMB caverns for a total capacity of 120 MMB (see figure 2.4.3-2). Except for a new RWI structure, the facility would use LOOP's existing infrastructure for cavern solution mining, brine disposal, and electrical power distribution. The drawdown rate would be up to 1.1 MMBD. A security buffer area would not be developed. However, DOE would install a perimeter fence around the caverns and supporting infrastructure. DOE also would construct an off-dome facility 4 miles (6 kilometers) to the west of the storage site along the facility access road (see figure 2.4.3-3). This facility would consist of a new office and control-room building, maintenance buildings, laboratory, and guardhouse complete with a security system as described in section 2.3.5. The description of a proposed co-development of Clovelly (80 or 90 MMB) with Bruinsburg (80 MMB) to reach 160 or 170 MMB of new storage capacity is described in section 2.4.4.

**The Louisiana Offshore Oil Port (LOOP)** is a private deepwater port operating off the coast of Louisiana. It is run by Louisiana Offshore Oil Port, Inc., a consortium of oil and gas producers. The onshore Clovelly dome storage system is a component of LOOP; it is not part of the existing SPR.

The LOOP complex is designed to accept crude oil from incoming supertankers capable of transporting approximately 2 MMB of oil per ship. The complex comprises a marine terminal located 20 miles (32 kilometers) offshore in the Gulf of Mexico and the onshore Clovelly dome storage facility. At its peak, this facility accepts 12 percent of the crude oil imported into the United States. When oil is accepted at the offshore marine terminal, it is unloaded from supertankers and transferred through pipelines at high flow rates to the Clovelly dome storage facility. Oil stored there is eventually delivered to the St. James terminal or to the Capline distribution complex.

Located in open water wetlands near the coast, LOOP's Clovelly dome storage facility can store up to 48 MMB of oil in eight salt dome caverns (see figure 2.4.3-2). The onsite caverns, wells, platforms, and pumping systems are accessible by barge. The control, office, and maintenance facilities are located west of the storage site. LOOP connects to an extensive crude oil distribution network, which would supply the crude oil for storage in the proposed SPR caverns. The brine disposal system includes a 220-acre (89-hectare), 28-MMB-capacity brine pond, and a 30-inch (76-centimeter) offshore diffuser pipeline with the capacity to dispose of 0.5 MMB of brine a day in the Gulf of Mexico.

Figure 2.4.3-1: Location of Proposed Clovelly 120 MMB Storage Site

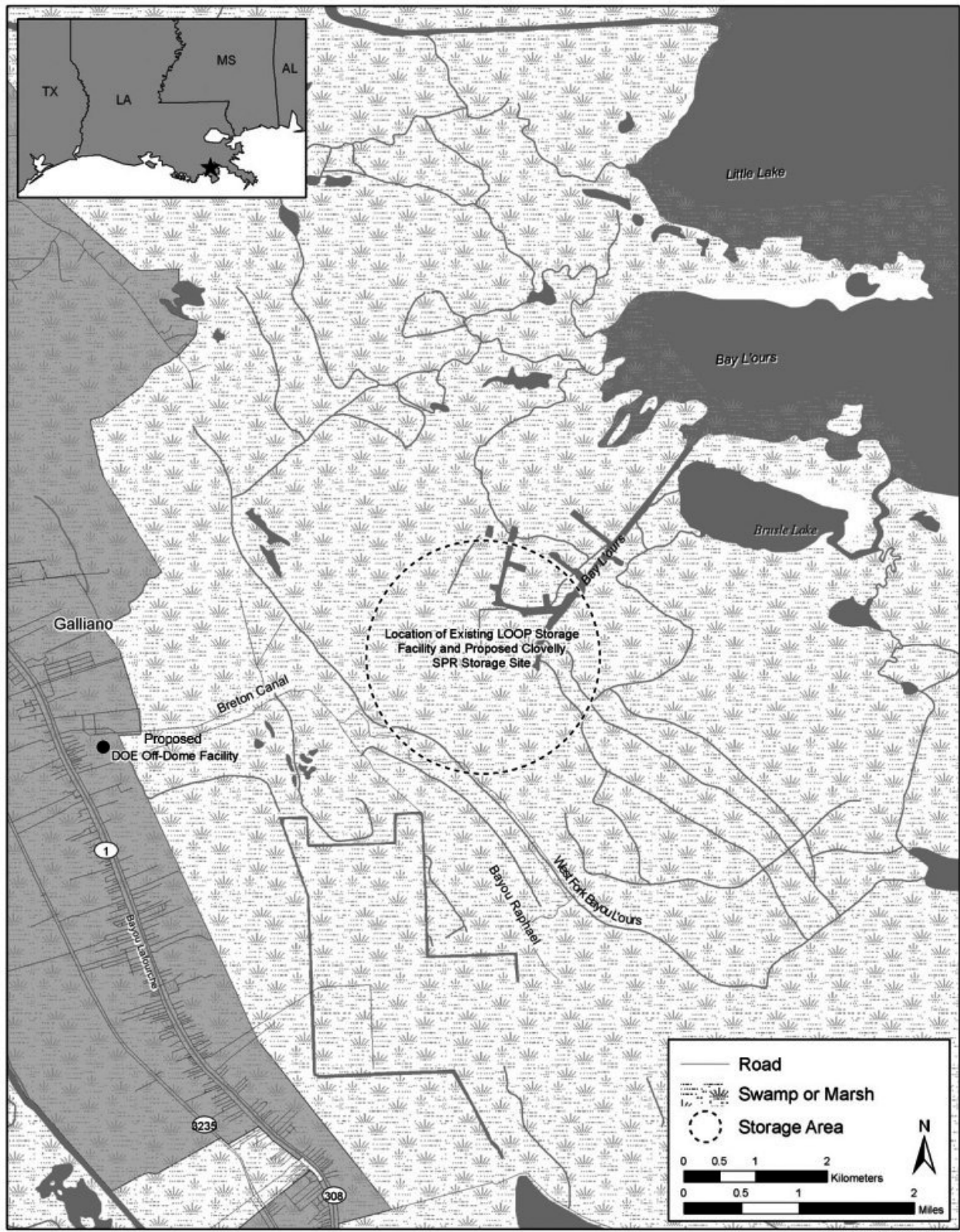


Figure 2.4.3-2: Proposed Layout of Clovelly 120 MMB Storage Site

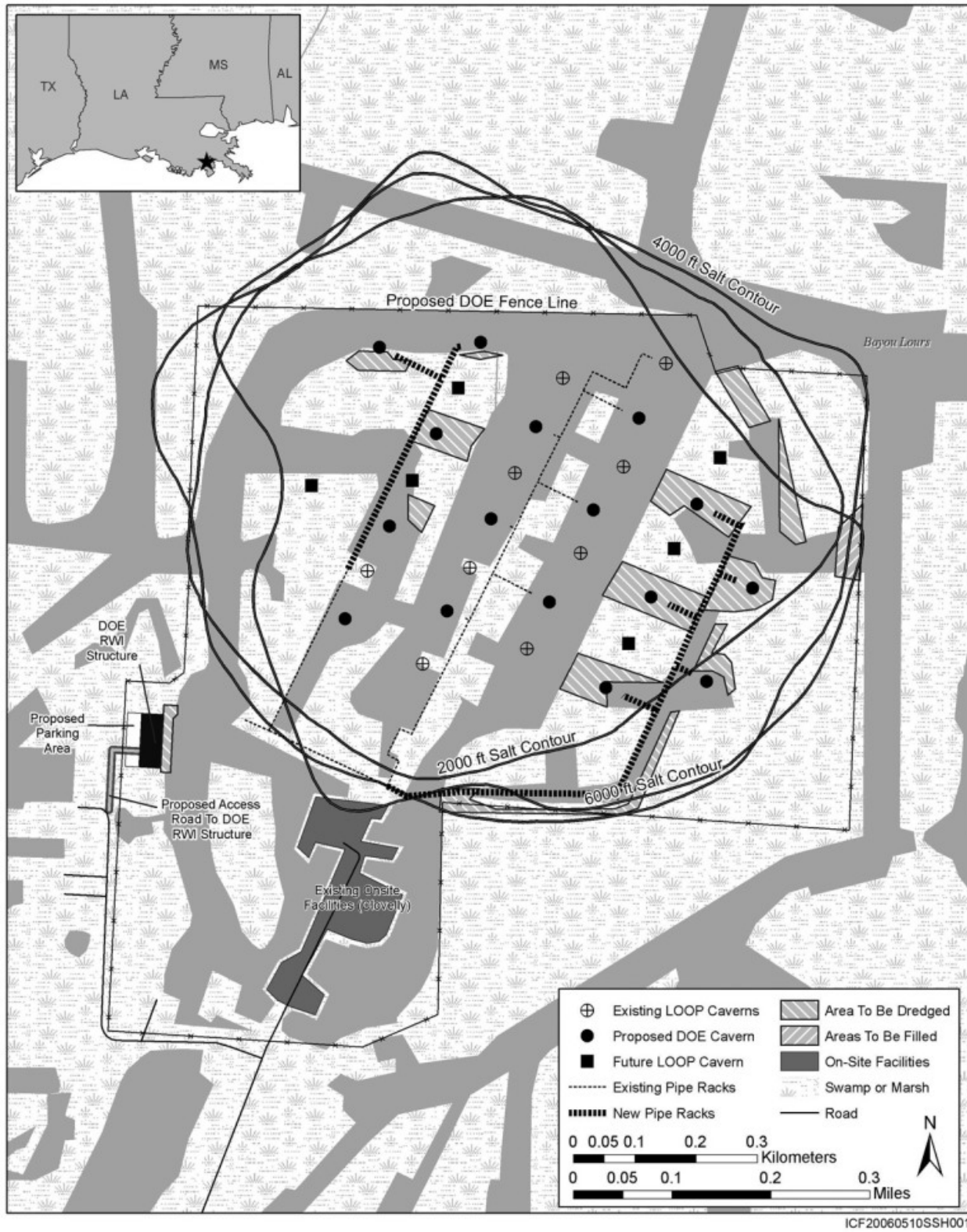
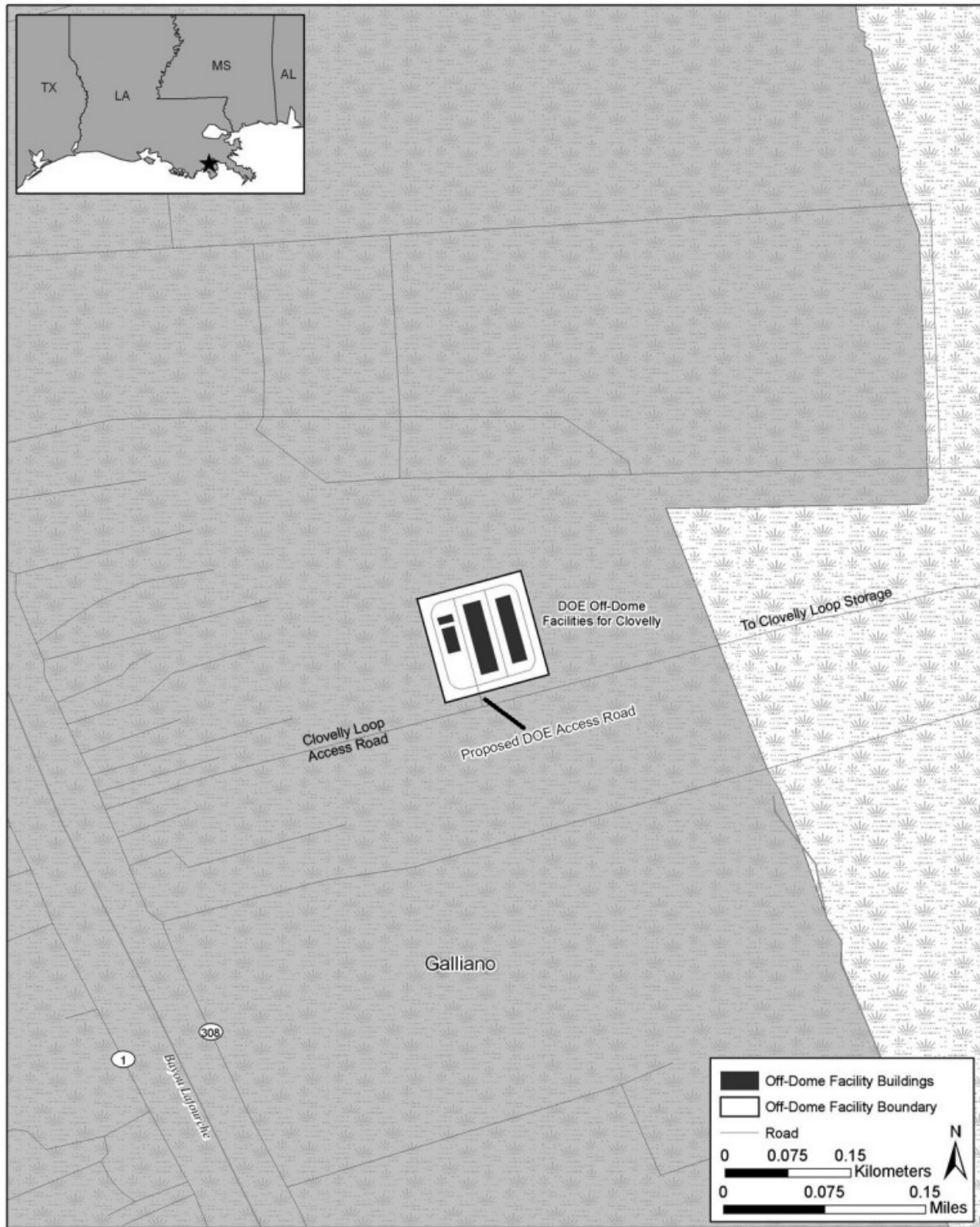


Figure 2.4.3-3: Proposed Layout of DOE Off-Dome Facilities



To operate a new SPR storage facility at Clovelly, DOE would construct 16 caverns with a solution-mined capacity of 7.5 MMB each at a depth of 3,500 to 6,000 feet (1,100 to 1,800 meters) and an off-dome facility (see figure 2.4.3-3). Existing LOOP caverns are at a depth of 1,500 to 3,000 feet (460 to 900 meters) below ground surface. The caverns would be arranged in rows that run roughly southwest to northeast in line with the existing LOOP storage caverns. The layout of the caverns is illustrated in figure 2.4.3-2.

No additional pipelines would need to be constructed as part of the crude oil distribution system, except for internal connection piping; however, four additional, 2,000-horsepower oil injection pumps would be needed onsite to meet increased cavern fill-rate requirements.

The new SPR facility would tie into the existing brine disposal system. DOE would use the existing 28-mile (45-kilometer), 30-inch (76-centimeter) brine disposal pipeline and brine pond, but it would install three new, 2,000-horsepower brine pumps. New brine collection piping from each cavern to the LOOP brine disposal platform also would be constructed. When feasible, brine from the Clovelly brine reservoir would be used for draw-down events rather than from the DOE RWI.

DOE would construct a new 1.2 MMB capacity RWI and a 0.1 mile (0.23 kilometers) access road approximately 0.1 miles (0.02 kilometers) southwest of the proposed and existing caverns on a construction footprint of 1.07 acres (0.43 hectares). The new RWI would ensure that DOE would have independent capacity for a draw down event. DOE would install four additional, 2,500-horsepower fresh water intake pumps at the RWI structure and six additional, 3,500-horsepower raw water injection pumps at the storage site. A 24- to 42-inch (61- to 107-centimeter) onsite raw water pipeline and cavern headers would be installed to connect the new caverns to the new system.

No additional power lines would need to be built at the site to supplement the existing 115-kilovolt substation which has redundant capacity. Two new cable lines would be needed at the existing site substation with no ROW requirements. Two 4.16-kilovolt cable lines from the site's switchgear would be required to power the RWI pumps. There would be no ROW requirements.

#### **2.4.4 Clovelly and Bruinsburg Storage Sites**

Under the Clovelly 80 MMB and Bruinsburg 80 MMB or the Clovelly 90 MMB and Bruinsburg 80 MMB alternatives, DOE would develop 80 MMB of storage at Bruinsburg and 80 or 90 MMB of storage at Clovelly, totaling 160 or 170 MMB. The development of the Clovelly site would be similar to the 120 MMB option, except that only 12 caverns of 6.7 MMB or 7.5 MMB would be constructed to achieve a total capacity of 80 or 90 MMB (see figure 2.4.4-1). The remaining elements associated with the 120 MMB Clovelly option would be associated with the 80 or 90 MMB development at Clovelly. The development of the 80 MMB Bruinsburg site would be similar to the 160 MMB option, with the exception of 8 rather than 16 10-MMB caverns would be built, only 30 brine injection wells would be installed, and a smaller (0.28 acres [0.11 hectares]) RWI would be constructed with a construction footprint of 0.47 acres (0.19 hectares) (see figure 2.4.4-2 and figure 2.4.4-3).

The crude oil pipeline from Bruinsburg to Anchorage, LA, would not be developed, nor would the pipeline be built to the Peetsville pumping station. A new 30-inch (76-centimeter) and 16-inch (41-centimeter) crude oil pipelines would be constructed to run 19 miles (30 kilometers) from the Bruinsburg site to a split, where the 30-inch (76-centimeter) pipeline would run another 35 miles (57 kilometers) to Jackson, MS, and the 16-inch (41-centimeter) pipeline would run another 13 miles (21 kilometers) to Vicksburg, MS, as illustrated in figure 2.4.4-4. The crude oil pipelines would connect to the Vicksburg Entergy system to use existing facilities and to the existing Capline Jackson Pump Station. At Jackson, a 71-acre (29-hectare) terminal/tank farm would be built containing four 0.4-MMB

Figure 2.4.4-1: Layout of Clovelly 80 or 90 MMB Storage Site

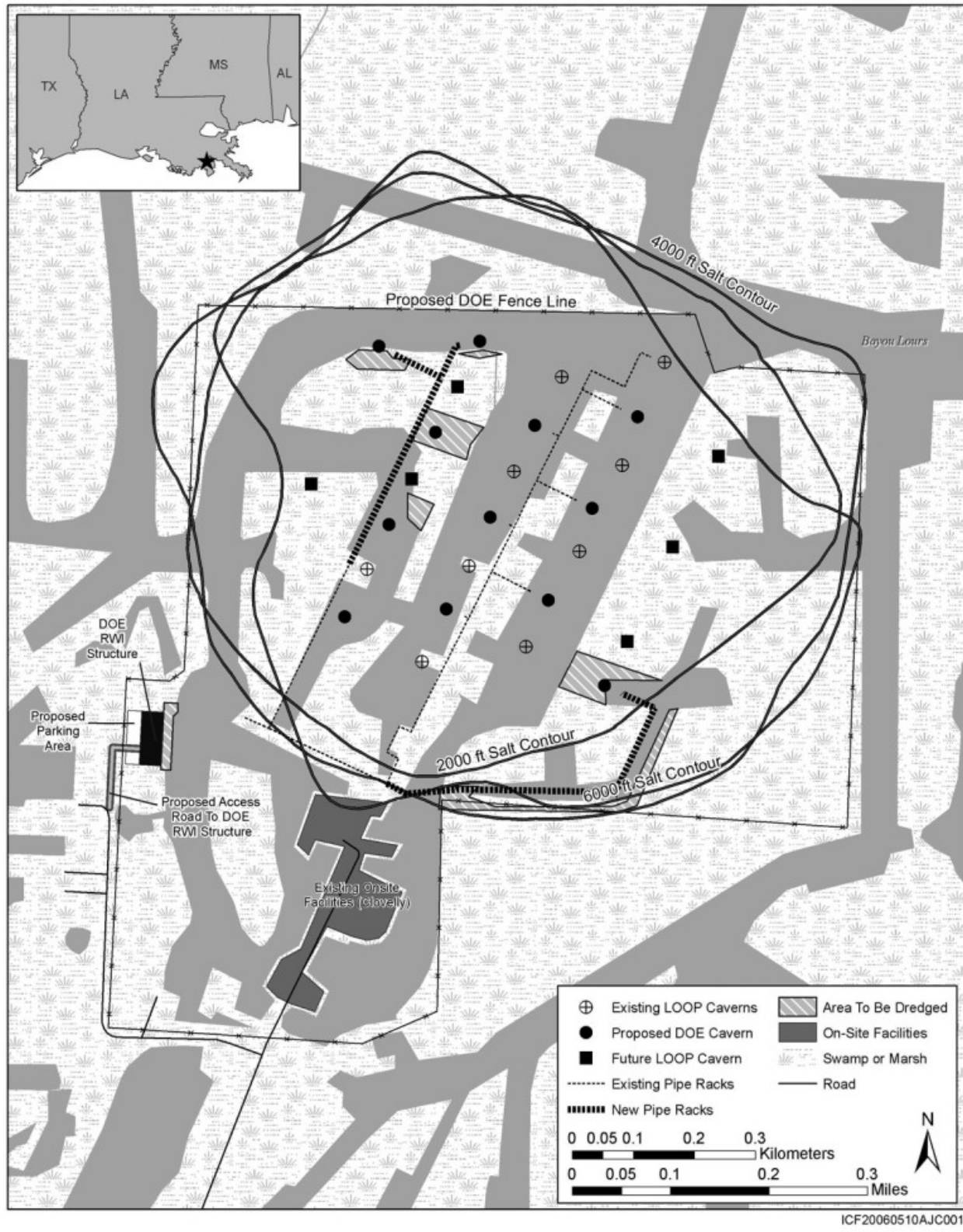
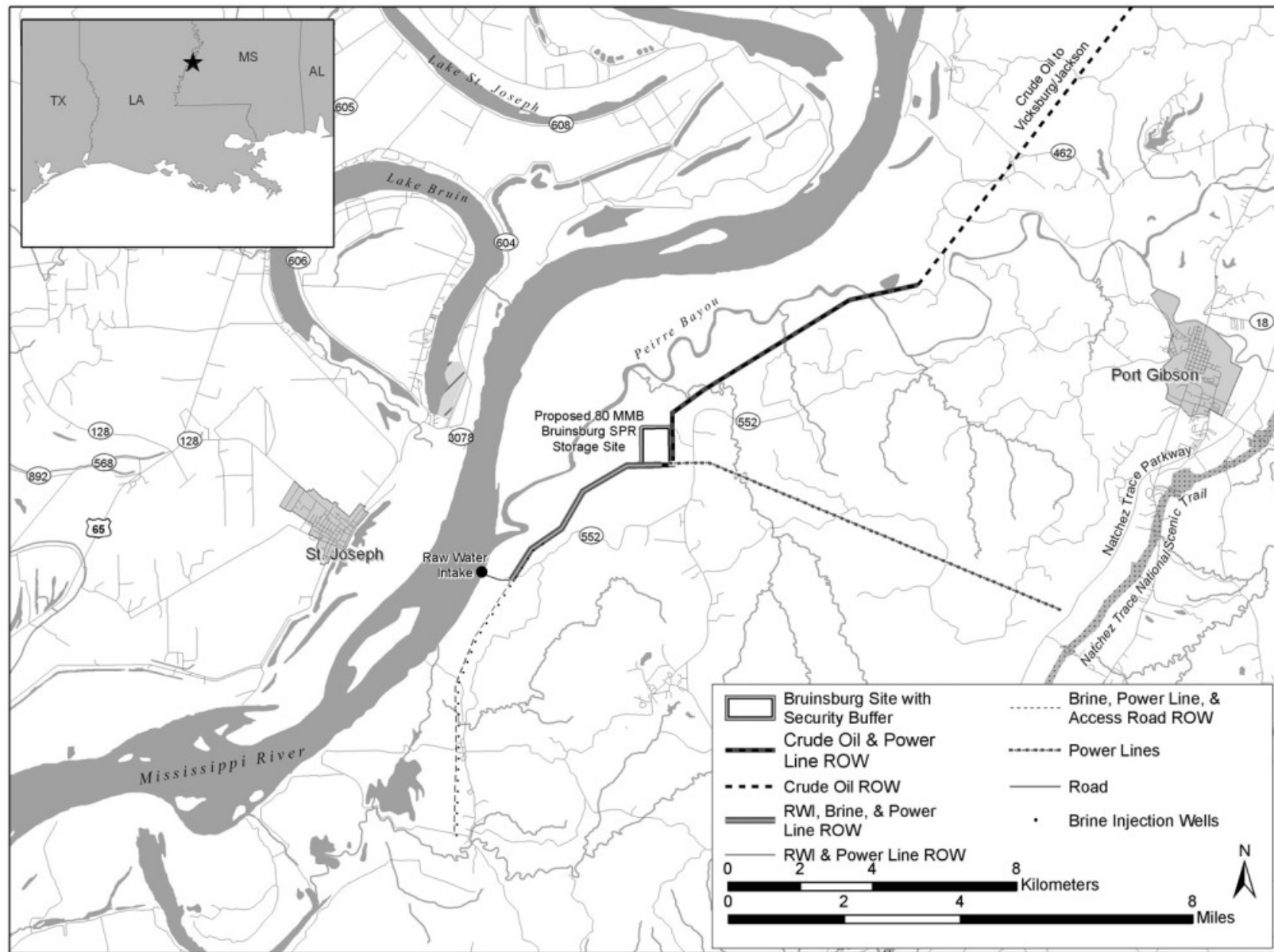


Figure 2.4.4-2: Location of Proposed Bruinsburg 80 MMB Storage Site



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**Figure 2.4.4-3: Proposed Layout for Bruinsburg 80 MMB Storage Site**

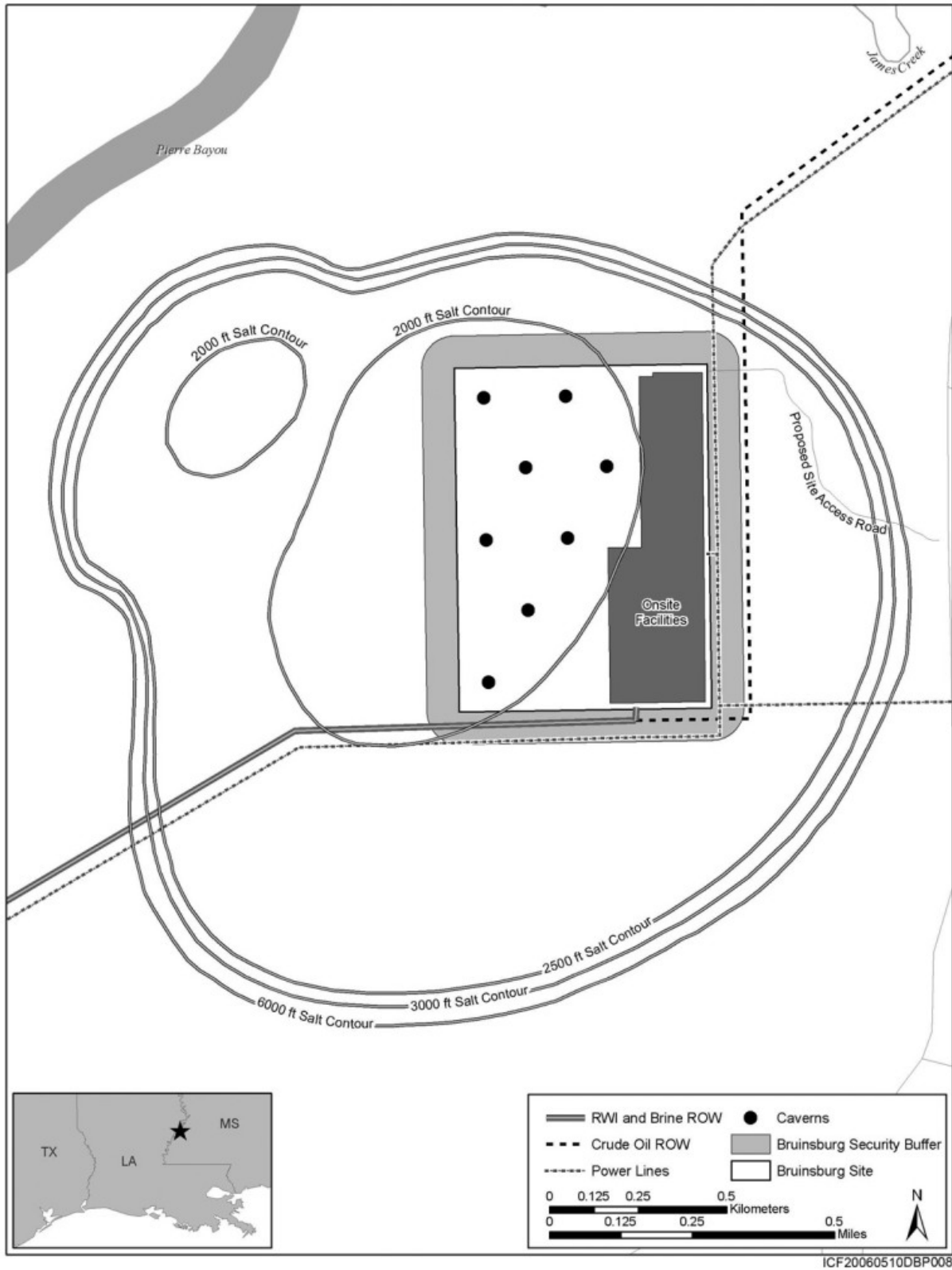
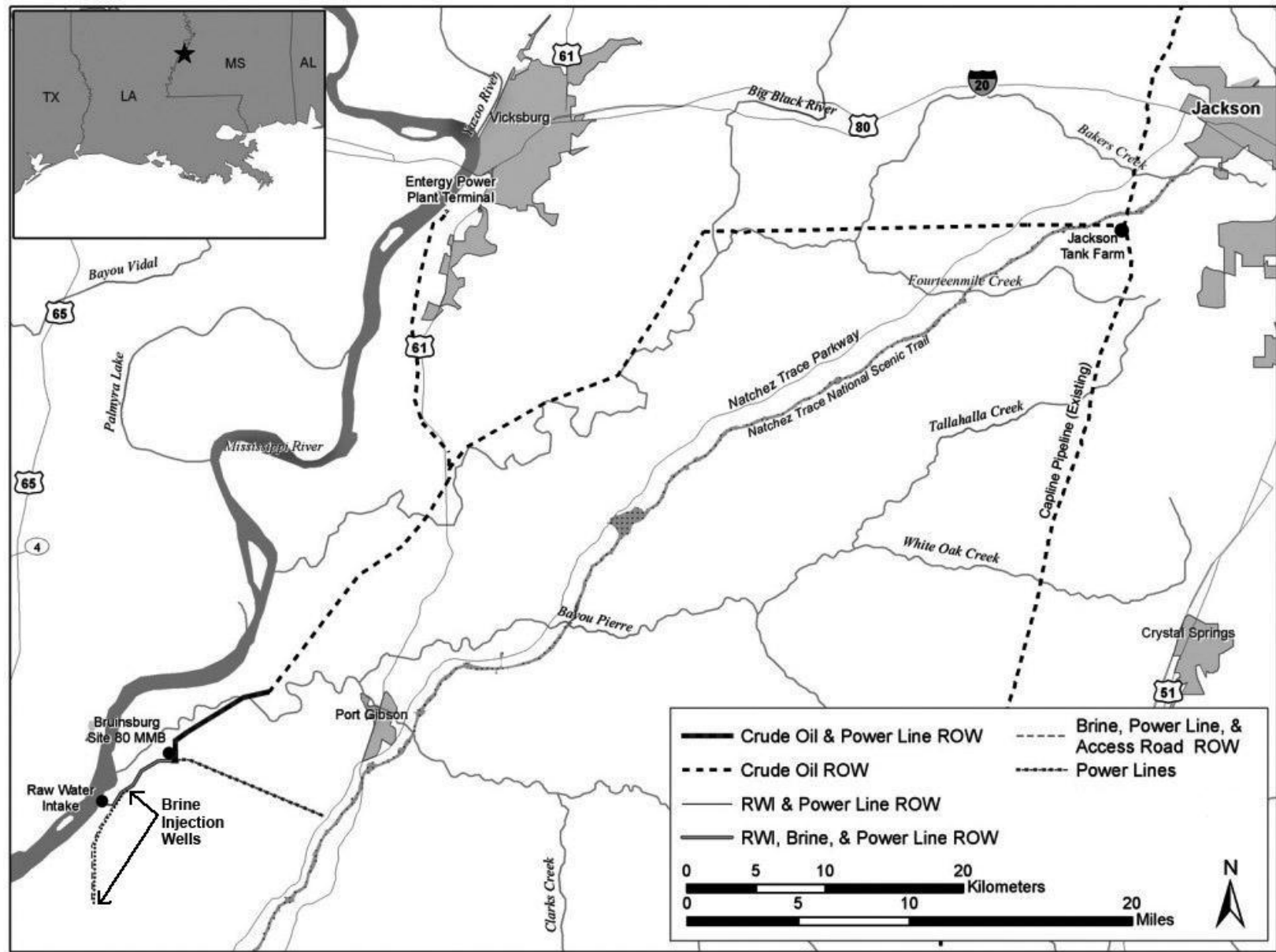


Figure 2.4.4-4: Proposed Pipelines for the Bruinsburg 80 MMB Storage Site



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oil storage tanks, support facilities, and an electrical substation. Figure 2.4.4-5 illustrates the proposed facilities at Jackson.

At the Bruinsburg SPR storage site, a 36-inch (91-centimeter) 8-mile (13-kilometer), rather than a 14-mile (22-kilometer), brine disposal pipeline would be built to transport the brine into underground injection wells. Thirty brine disposal wells would be spaced at 1,000-foot (300-meter) intervals along the ROW, but only 20 wells would operate at any one time. Ten wells would be on standby or down for routine maintenance. For information regarding the specifics of development at these two sites (see sections 2.4.3 and 2.4.1). A 5-mile (9-kilometer) road rather than an 11-mile (18-kilometer) road would be constructed along the brine disposal pipeline for brine well construction and maintenance. Five miles (9 kilometers) of parallel 7.5 kilovolt power lines would extend along the brine disposal pipeline to power the injection wells.

#### **2.4.5 Richton Storage Site**

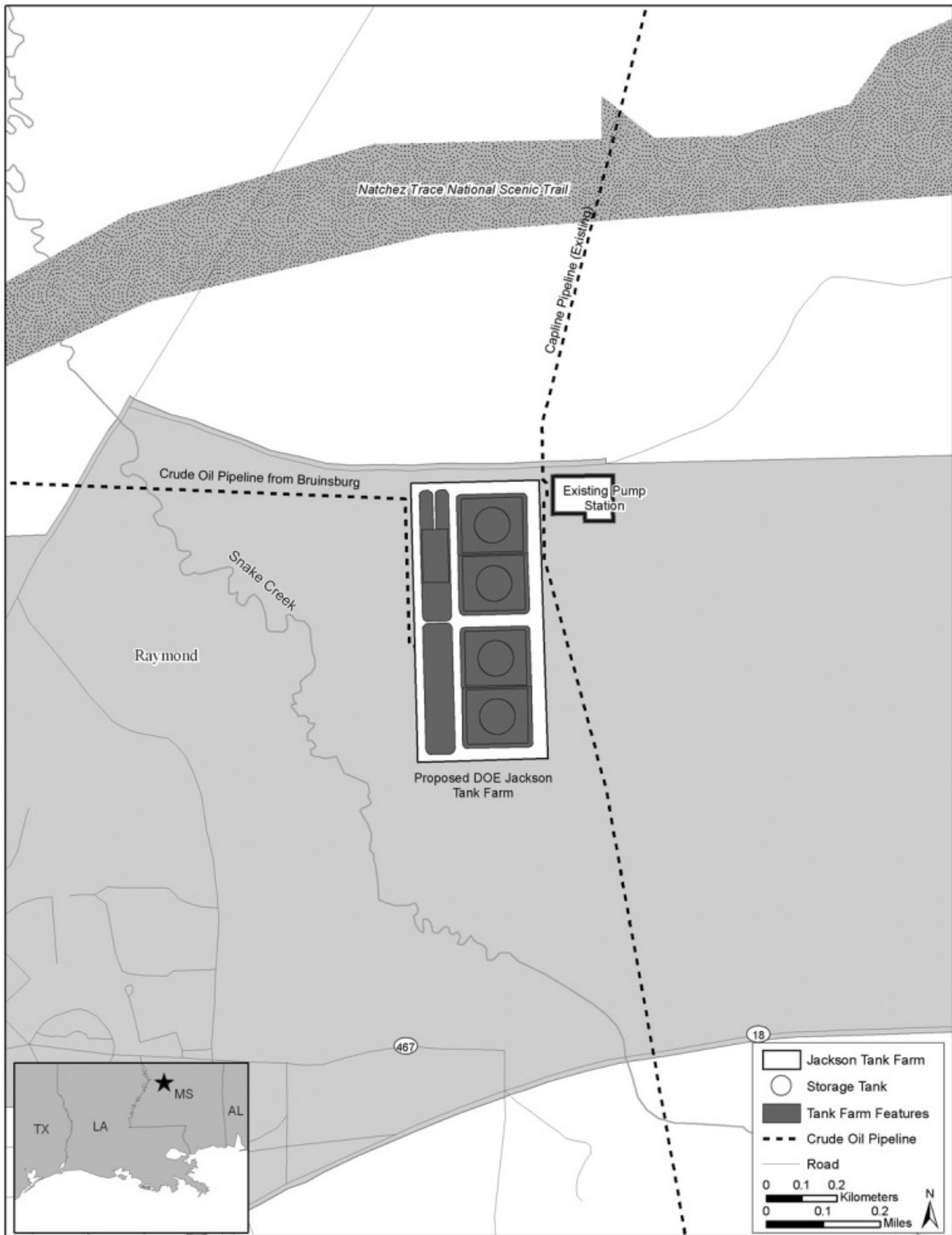
The Richton salt dome is located in northeastern Perry County, MS, 18 miles (29 kilometers) east of Hattiesburg and 3 miles (4.8 kilometers) northwest of the town of Richton. This proposed new site would consist of 16 new caverns with a combined capacity of up to 160 MMB. The maximum drawdown rate would be 1.1 MMBD.

The Richton site would encompass approximately 238 acres (96 hectares) and would include a new 0.2 mile (0.3 kilometer) access road from Route 42. In addition, a surrounding security buffer would be created by clearing an area of 109 acres (44 hectares) 300 feet (91 meters) beyond an outer security fenceline for line-of-sight surveillance (see figure 2.4.5-1). The area would be cleared of undergrowth, scrub, shrub, and any trees, and would be managed as an open field. To do this, DOE might purchase additional land or make agreements with owners of abutting lands. DOE would construct 16 new, 10-MMB caverns, 7 raw water injection pumps, 4 brine injection pumps, 2 brine ponds, 5 oil injection pumps, and numerous onsite buildings. The caverns would be arranged in three rows (two rows of five and one row of six), extending south to north. This proposed layout appears in figure 2.4.5-2.

Raw water would be drawn from the Leaf River through a 42-inch (107-centimeter) pipeline that would traverse approximately 10 miles (16 kilometers). The pipeline would run due south from the proposed site, across the Plantation Pipeline ROW, to a point on the river. A RWI would be constructed on a 1.07-acre (0.44-hectare) site and would house four 2,500-horsepower raw water injection pumps and auxiliary structures. Another seven 2,500-horsepower RWI pumps would be installed at the Richton site. The raw water pipeline would be co-located for about 6 miles (9 kilometers) of the ROW with the brine disposal pipeline and the crude oil fill pipeline. A 2.3 mile (3.7 kilometer) access road would be constructed from Old Augusta Road to the RWI structure. The RWI pipeline is illustrated in figure 2.4.5-3.

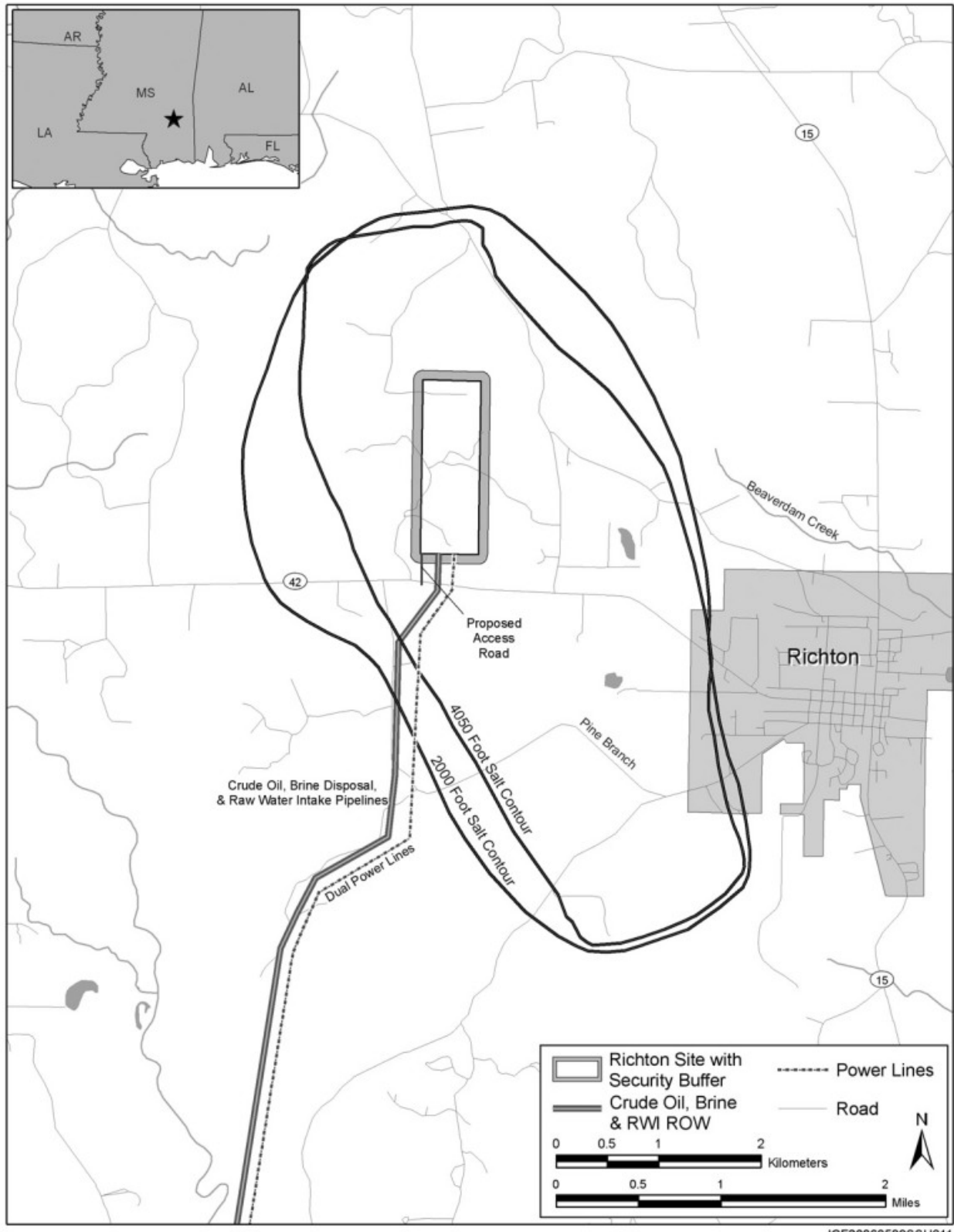
DOE would build two dual-purpose brine and crude oil pipelines to Pascagoula (see figure 2.4.5-3). Each pipeline would be used to transport brine and crude oil for specific periods of construction and operation. During construction the 88-mile (142-kilometer) 16-inch (41-centimeter) pipeline would be used to transport crude oil to the site to provide blanket oil for cavern development, and the 48-inch (122-centimeter) 87-mile (140-kilometer) pipeline would be used to transport brine from the site to Pascagoula and then out to the Gulf of Mexico along a 48-inch (122-centimeter) 13-mile (20-kilometer) offshore pipeline to the brine diffuser. The coordinates of the offshore diffuser would be 30°09'06"N and 88°33'39"W. Once construction of all the caverns had been completed, the 16-inch (41-centimeter) pipeline would transport the smaller volumes of brine associated with operation (cavern filling) to the 48-inch (122-centimeter) offshore brine pipeline and the 48-inch (122-centimeter) pipeline would transport crude oil to and from the site.

**Figure 2.4.4-5: Proposed Layout of Jackson Tank Farm**

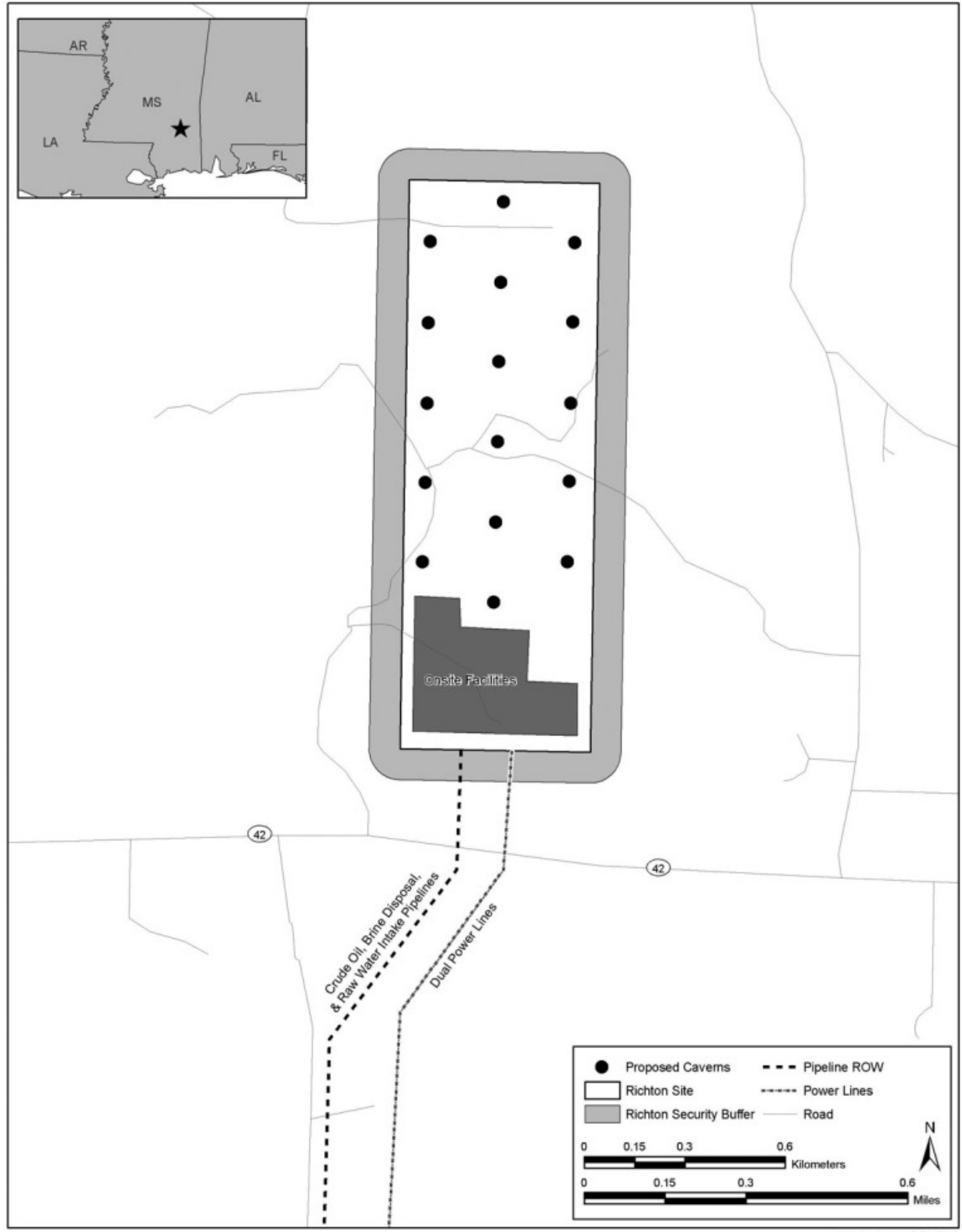


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**Figure 2.4.5-1: Location of Proposed Richton Storage Site**

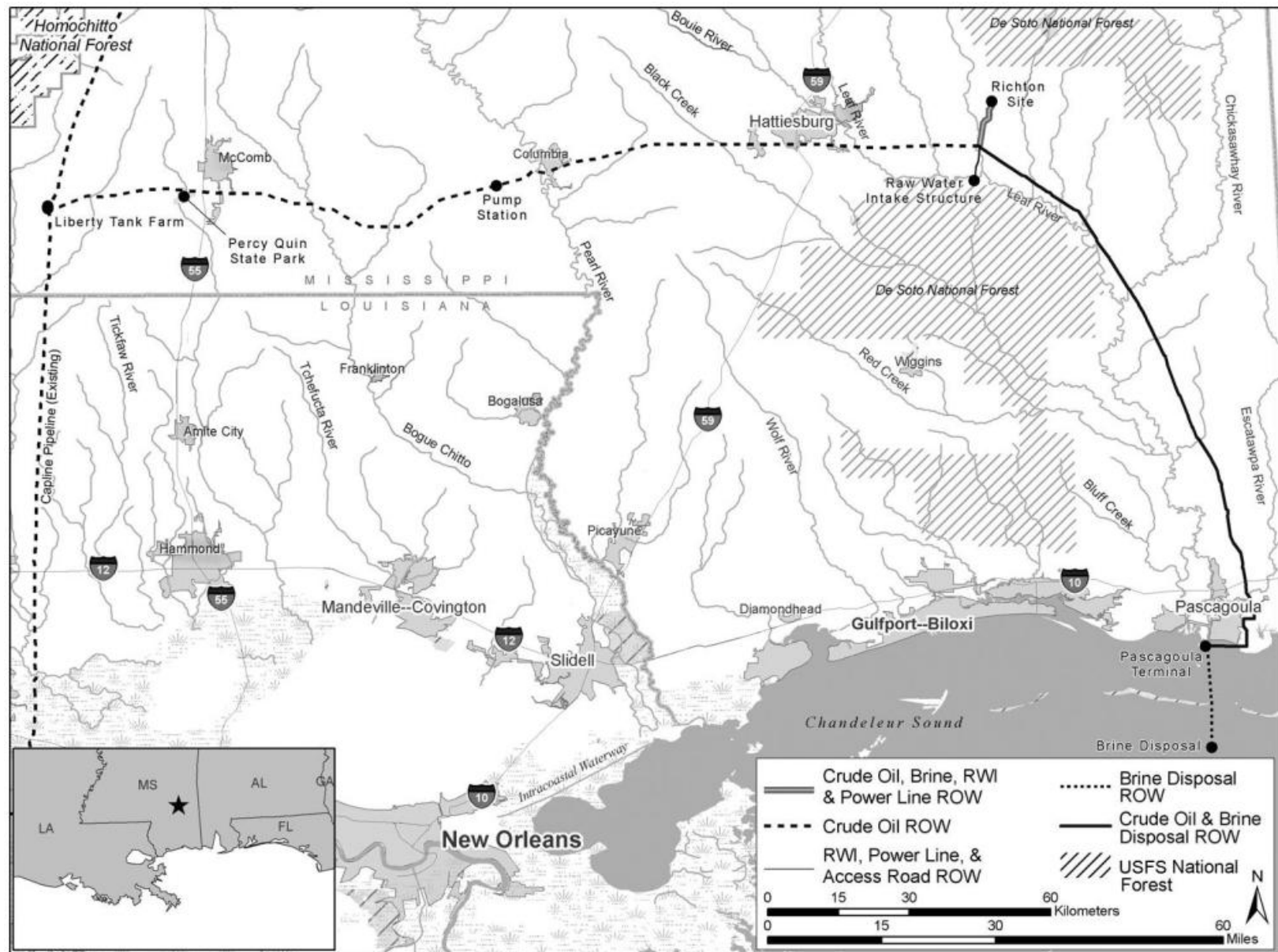


**Figure 2.4.5-2: Proposed Layout of Richton Storage Site**



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Figure 2.4.5-3: Proposed Pipelines for Richton Storage Site



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Crude oil also would be transported to and from the Richton SPR facility through a 36-inch (91-centimeter), 116-mile (186-kilometer) pipeline to the Capline Complex in Liberty, as illustrated in figure 2.4.5-3. Near this connection, DOE would construct four 0.4-MMB oil storage tanks, support facilities, and an electrical substation, which would require a site of approximately 66 acres (27 hectares) (see figure 2.4.5-4). At the midpoint of the pipeline route, DOE would construct a midpoint pump station consisting of three, 2,000-horsepower, diesel-powered pumping units on a 1.7-acre (0.7-hectare) site.

A new DOE-owned and -operated terminal/tank farm would be built adjacent to an existing dock that DOE would acquire and operate. These facilities would be located on the Naval Station Pascagoula Base Realignment and Closure site located on the north side of man-made Singing River Island, which lies just south of the main port of Pascagoula. This site of 63 acres (26 hectares) would contain four 0.4-MMB oil storage tanks, support facilities, and an electrical substation. The dock would be refurbished and the only in-water construction would be the installation of pilings. Figure 2.4.5-5 illustrates the proposed facilities.

Two 138-kilovolt power lines would be built to a substation at the site, from local utility lines at a point 11 miles (18 kilometers) south. The parallel power line would require a 150-foot (46-meter) ROW. These power lines would run approximately 1 mile (1.6 kilometers) north to pass directly adjacent to the RWI, and then share the ROW with the RWI intake pipeline for the remaining 10 miles (16 kilometers) to the site. A short 0.05-mile (0.08-kilometer) connection would be made to the RWI substation from these power lines.

#### **2.4.6 Stratton Ridge Storage Site**

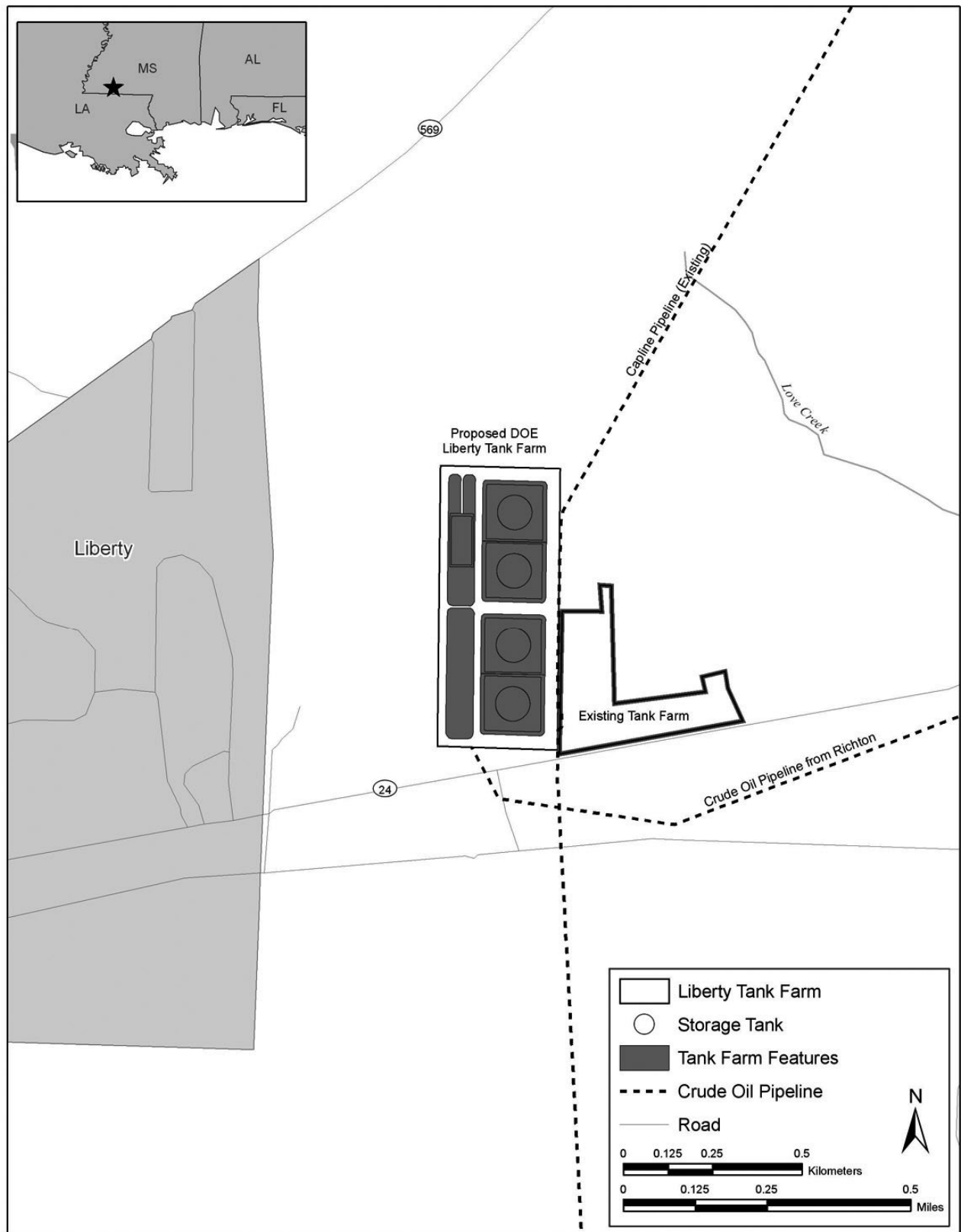
The Stratton Ridge salt dome is located in Brazoria County, TX, 3 miles (4.8 kilometers) east of Clute and Lake Jackson and 6 miles (9.7 kilometers) north of Freeport, as illustrated in figure 2.4.6-1. This proposed new site would consist of 16 new caverns with a combined capacity of up to 160 MMB. The drawdown rate would be up to 1.0 MMBD.

The proposed site encompasses approximately 269 acres (109 hectares) in the south-central portion of the salt dome. In addition, a surrounding security buffer would be created of 102 acres (41 hectares) by clearing an area 300 feet (91 meters) beyond an outer security fenceline for line-of-sight surveillance. The land would be cleared of undergrowth, scrub, shrub, and any trees, and be managed as an open field. To do this, DOE might purchase additional land or make agreements with owners of abutting lands. Although there is some cattle ranching in the vicinity of Stratton Ridge, the economy of the area centers on the petrochemical industry. Fifty-seven brine and crude oil storage caverns with an approximate total volume of about 150 MMB are currently operated at the Stratton Ridge salt dome by Dow, British Petroleum, Conoco, and Occidental.

DOE would construct 16 new, 10-MMB-capacity caverns, 7 raw water injection pumps, 4 brine injection pumps, 2 brine ponds, 5 oil injection pumps, and numerous onsite buildings. DOE would construct a 0.7 mile (1.1 kilometer) site access road from Route 523 to the site. Offsite construction would include an RWI structure of 0.54 acres (0.22 hectares) on a construction footprint of 1.07 acres (0.43 hectares) on the ICW. The layout of the caverns appears in figure 2.4.6-2. A 0.7-mile (1-kilometer) access road would be built.

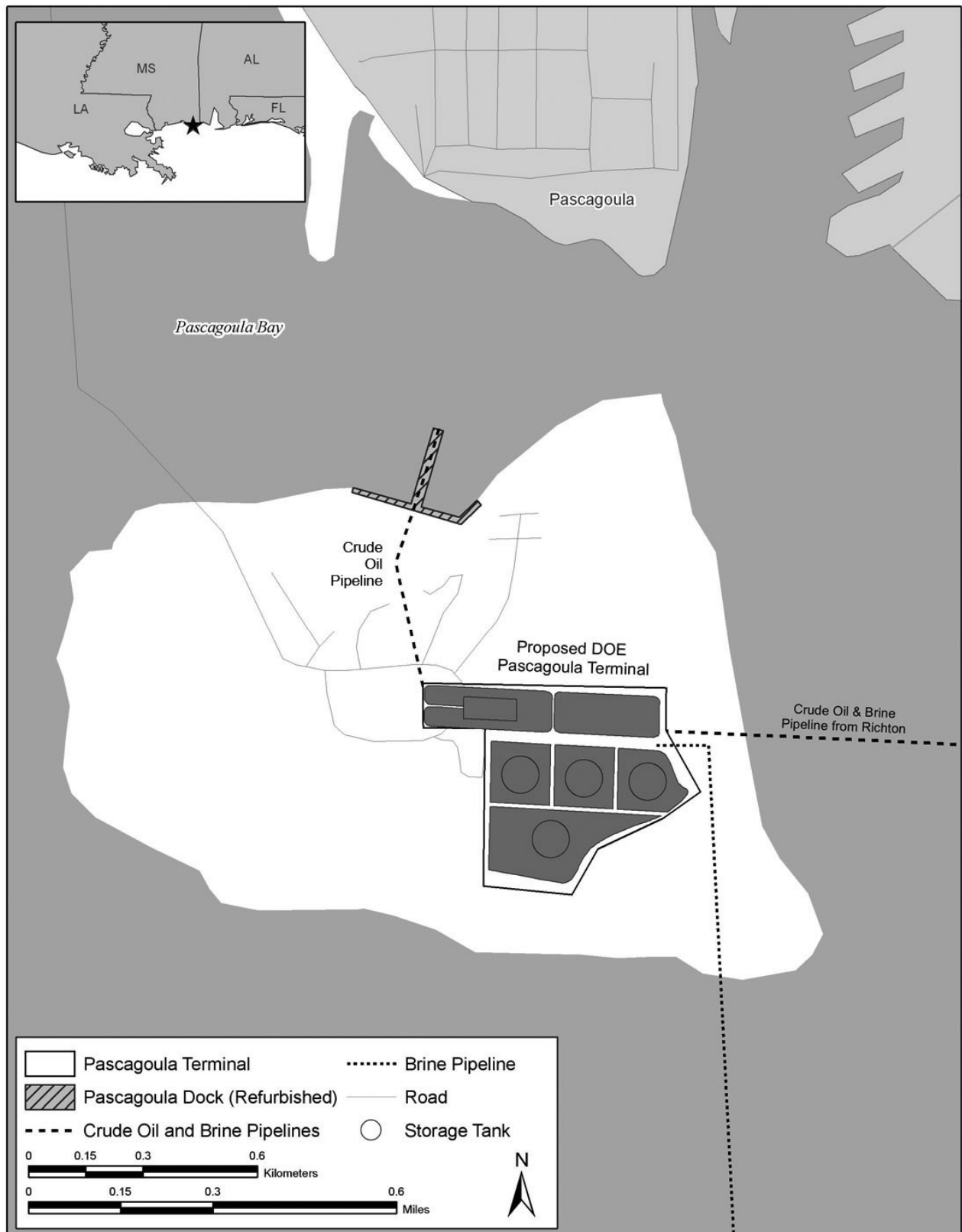
The RWI structure would be located 8 miles (13 kilometers) southwest of the site on the south side of the ICW, and it would contain four 2,500-horsepower raw water lift pumps. DOE would construct a 0.25 mile (0.4 kilometer) access road to the RWI structure. A 6-mile (10-kilometer) 42-inch (107-centimeter) raw water pipeline would be used to transport raw water from the ICW to the site for cavern solution

**Figure 2.4.5-4: Proposed Layout of the Liberty Tank Farm**



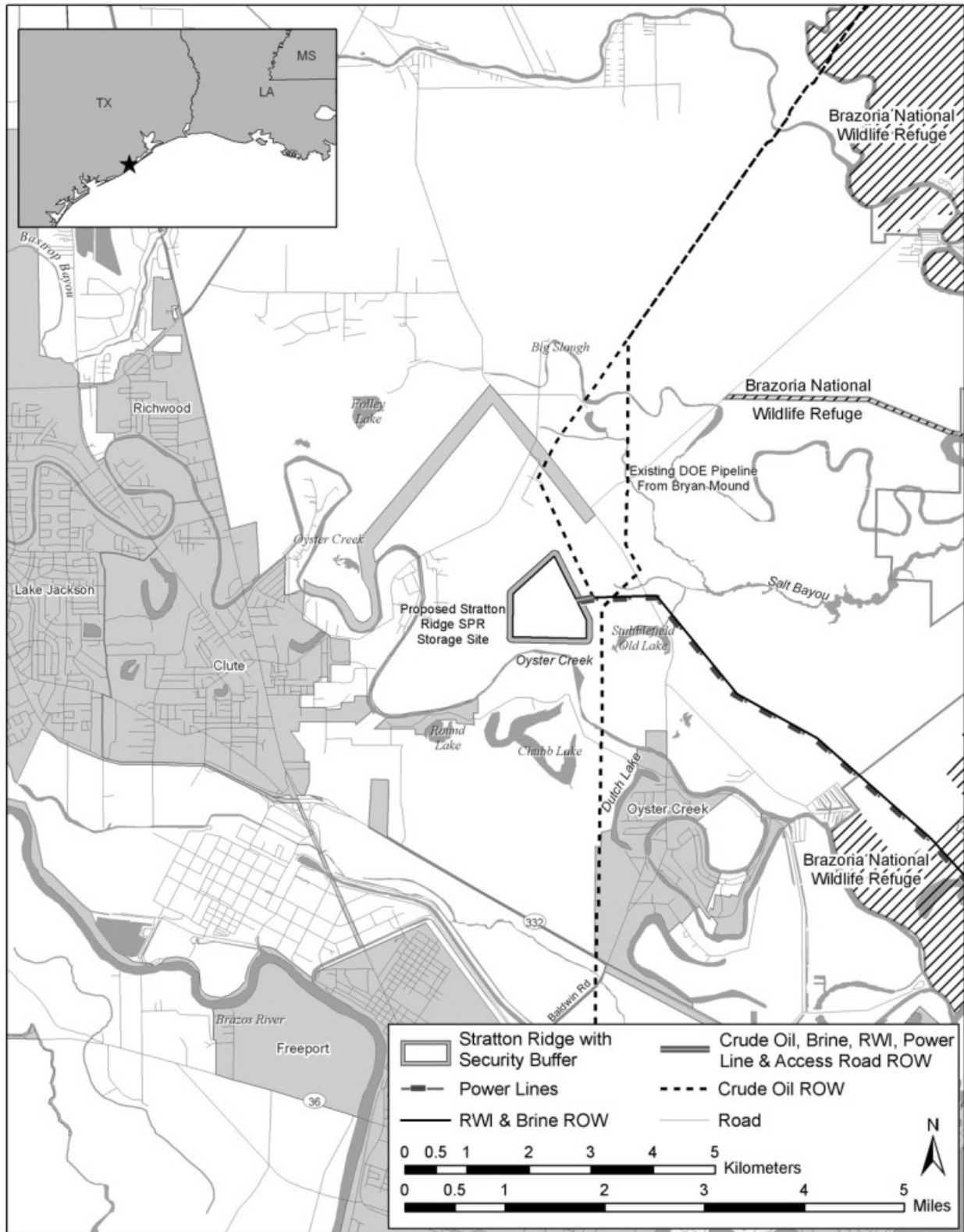
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**Figure 2.4.5-5: Proposed Layout of the Pascagoula Terminal**



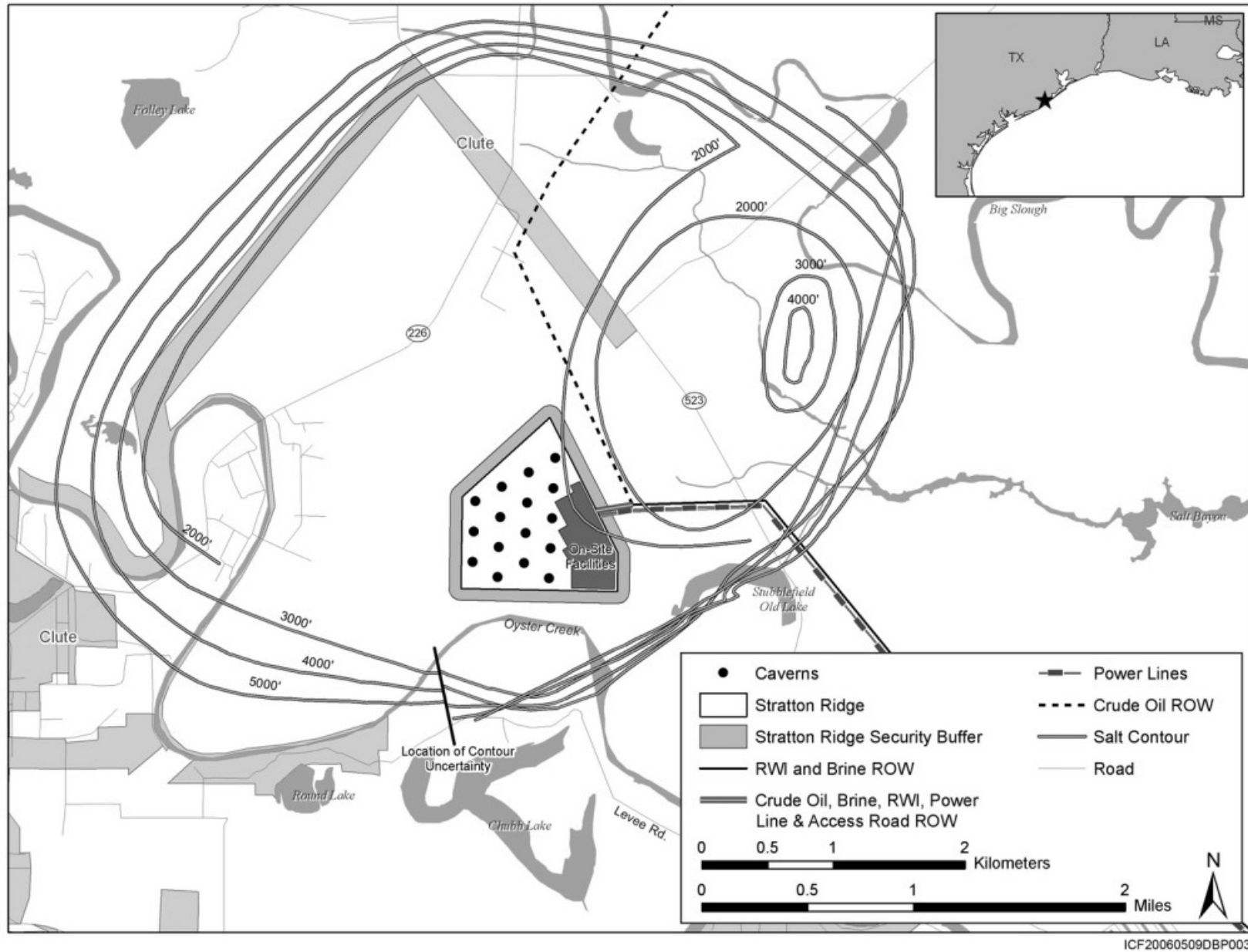
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**Figure 2.4.6-1: Location of Proposed Stratton Ridge Storage Site**



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Figure 2.4.6-2: Proposed Layout for Stratton Ridge Storage Site



mining and oil drawdown. The pipeline would have a throughput capacity sufficient to solution-mine caverns at a rate of 1.0 MMBD, and it would provide adequate water for drawdown.

A 10-mile (16-kilometer), 48-inch (122-centimeter) brine disposal pipeline would carry the brine to a depth of 30 feet (9 meters) into the Gulf of Mexico (see figure 2.4.6-3). Diffuser ports would be located on the final 4,000 feet (1,200 meters) of the pipeline. The 7-mile (11-kilometer) onshore portion of the pipeline would share the ROW with the RWI pipeline described earlier. The 3-mile (5-kilometer) offshore portion of the pipeline would lie perpendicular to the coast to take advantage of ocean currents for maximizing diffusion. Its terminus would be located at coordinates 28°56'36"N and 95°13'18"W.

A 42-inch (107-centimeter) 37-mile (60-kilometer) crude oil pipeline would be built to a proposed terminal/tank farm in Texas City adjacent to the existing Bryan Mound-Texas City pipeline (see figure 2.4.6-3). This tank farm would interconnect with an abutting BP facility via two proposed 30-inch (76-centimeters), 3-mile (4-kilometer) pipelines. It would contain four 0.4-MMB oil storage tanks, support facilities, and an electrical substation and would occupy a 39-acre (16-hectare) site. A cross-connection would also be made to the existing crude oil pipeline from Bryan Mound to Texas City. This configuration would allow oil fill and crude oil transfers between the Stratton Ridge and Bryan Mound sites. Figure 2.4.6-4 illustrates the proposed tank farm at Texas City.

An existing 138-kilovolt power lines run along the north eastern boundary of the site and would be directly connected to a site substation that would be built adjacent to these existing power lines. Dual 34.5-kilovolt power lines would be built from the site substation to the RWI adjacent to the RWI pipeline along a 6-mile (10-kilometer) 60-foot (18-meter) ROW. The portion of the dual 34.5 kilovolt power lines that pass through the Brazoria National Wildlife Refuge would be constructed underground rather than along poles.

## **2.5 EXPANSION AT EXISTING SPR SITES**

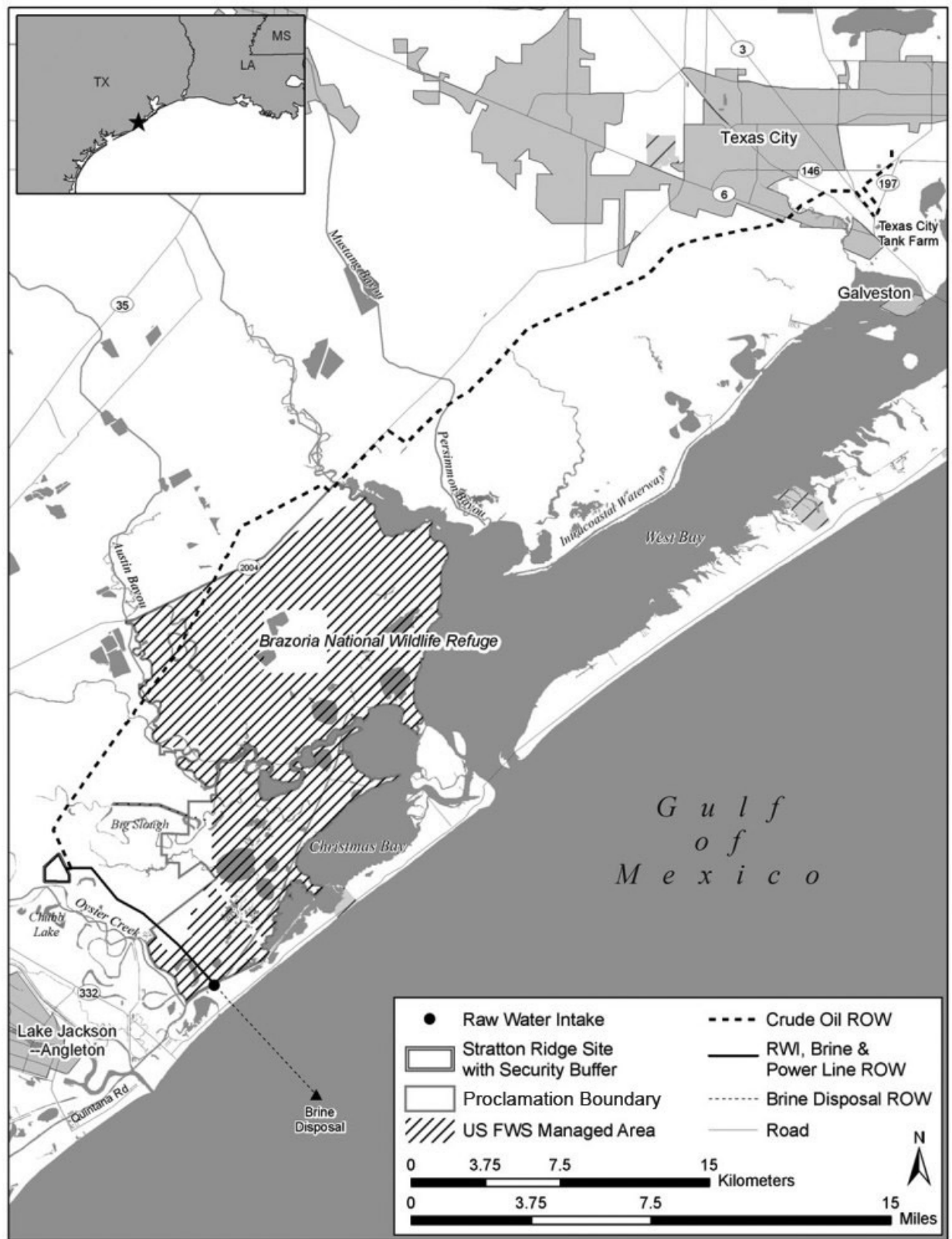
This draft EIS considers the expansion of two existing SPR storage sites, Bayou Choctaw, LA, Big Hill, TX as well as the potential expansion of West Hackberry, LA. The location of each facility is illustrated in figure 2.5-1. Storage capacity at Big Hill would be expanded by between 72 and 108 MMB; Bayou Choctaw would be expanded by 20 or 30 MMB; and West Hackberry would be expanded by 15 MMB or not at all. The specific amount of expansion would depend on the alternative that DOE selects.

### **2.5.1 Bayou Choctaw Expansion Site**

Bayou Choctaw occupies a 356-acre (144-hectare) site in Iberville Parish, LA, about 12 miles (19 kilometers) southwest of Baton Rouge, as illustrated in figure 2.5.1-1. The Mississippi River is located about 4 miles (6.4 kilometers) east of the salt dome and the Port Allen Canal, an extension of the ICW, is about 0.25 miles (0.4 kilometers) to the west. The general area is swampy with an elevation ranging from less than 5 feet (1.5 meters) to more than 10 feet (3 meters) above mean sea level.

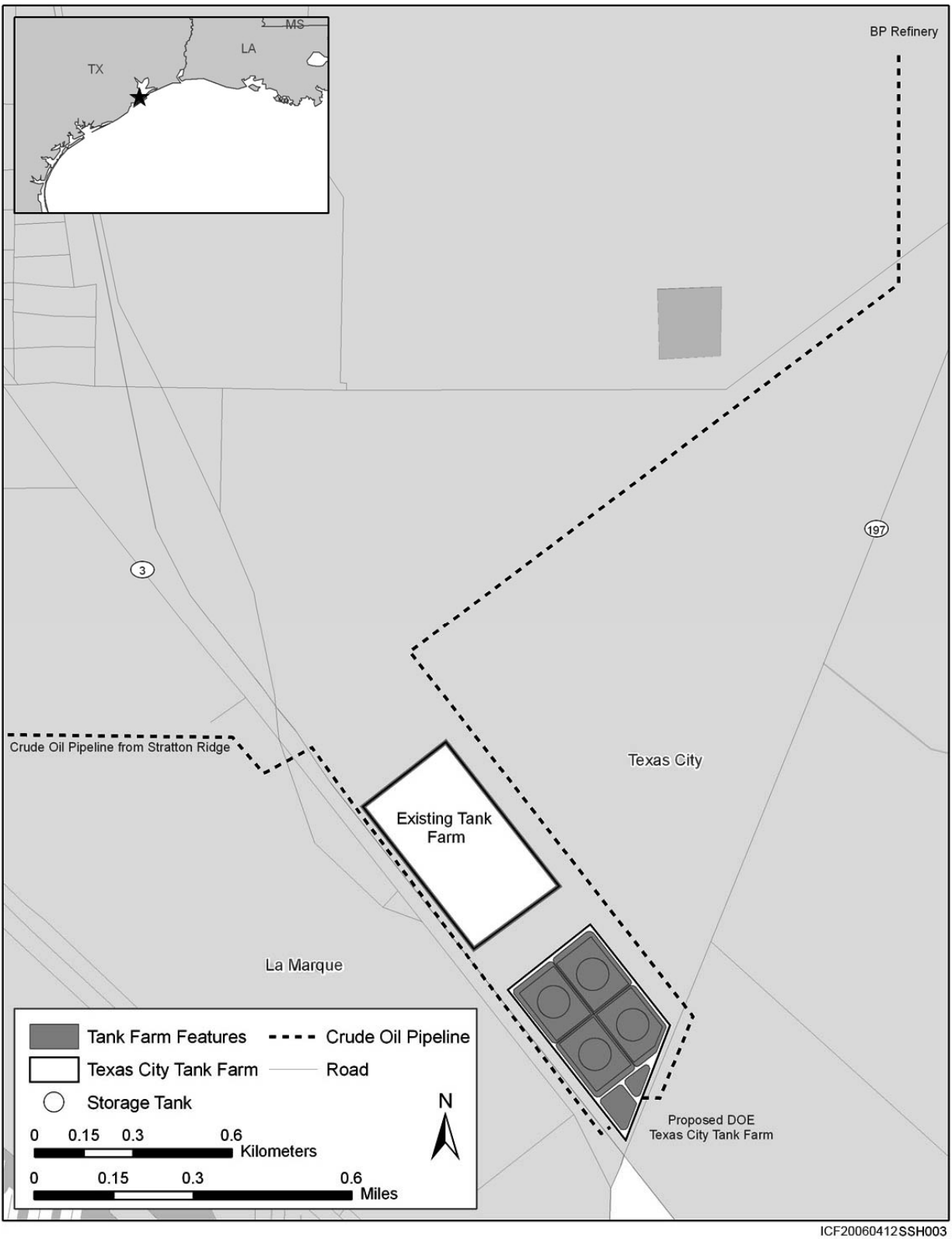
The existing storage facility consists of six caverns with approximately 12.5 MMB capacity each (see figure 2.5.1-2). Combined storage capacity is 76 MMB with a drawdown rate of 515 MMBD. Raw water is supplied from an intake facility on Cavern Lake to the north of the site. The lake has a surface area of approximately 12 acres (5 hectares) and it is connected by canal to the ICW. Brine is disposed of through underground injection wells south of the storage site. DOE would expand the storage capacity of the Bayou Choctaw facility by 20 MMB by developing two new 10-MMB caverns on the existing DOE property or to 30-MMB by also acquiring one existing 10-MMB commercial cavern from Petrologistics Olefins that is already located within the site boundary. The existing cavern currently stores ethane or ethylene, but it would be emptied and filled with brine before transfer of ownership to DOE. The new

Figure 2.4.6-3: Proposed Pipelines for Stratton Ridge Storage Site

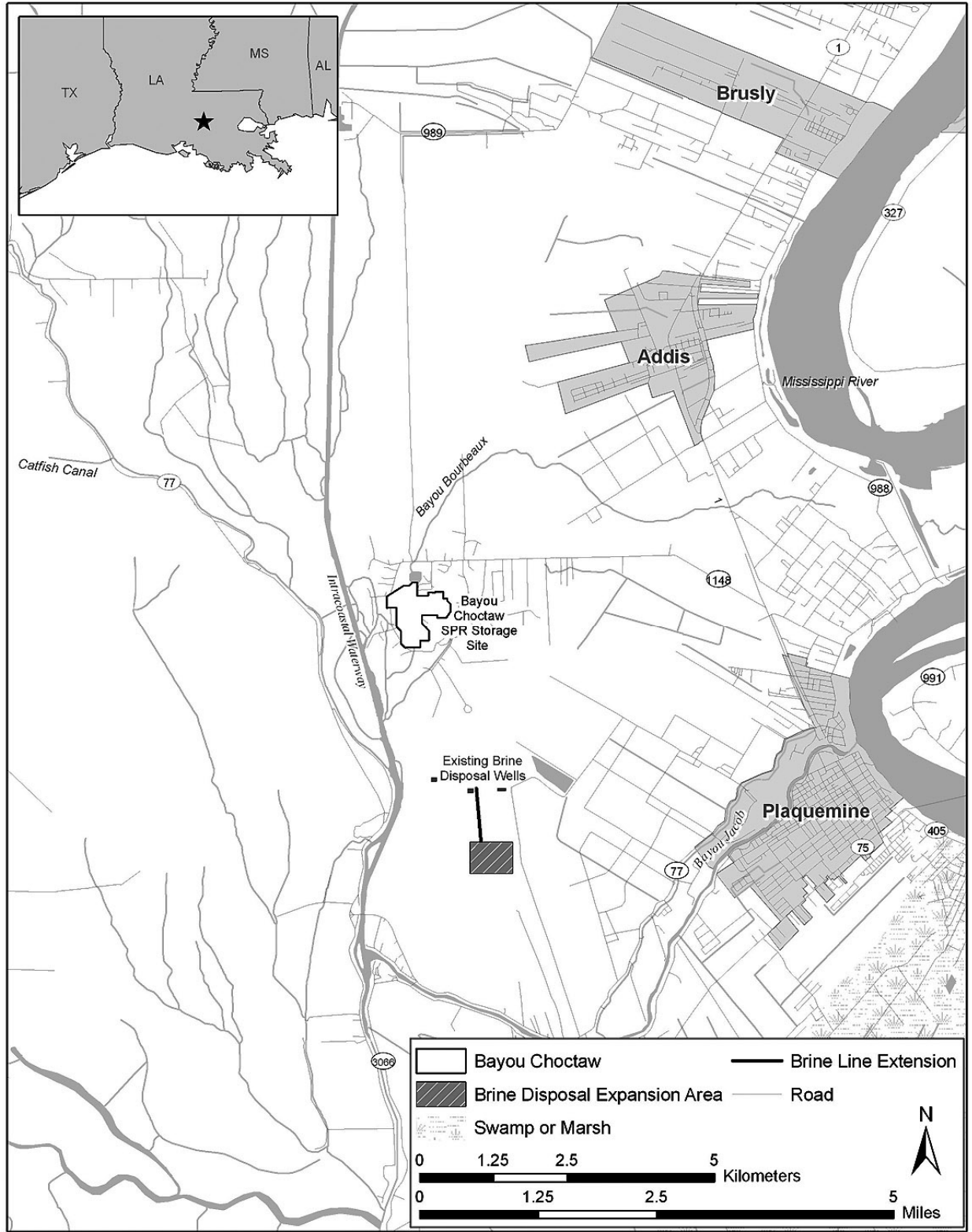


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**Figure 2.4.6-4: Proposed Layout of Texas City Tank Farm**

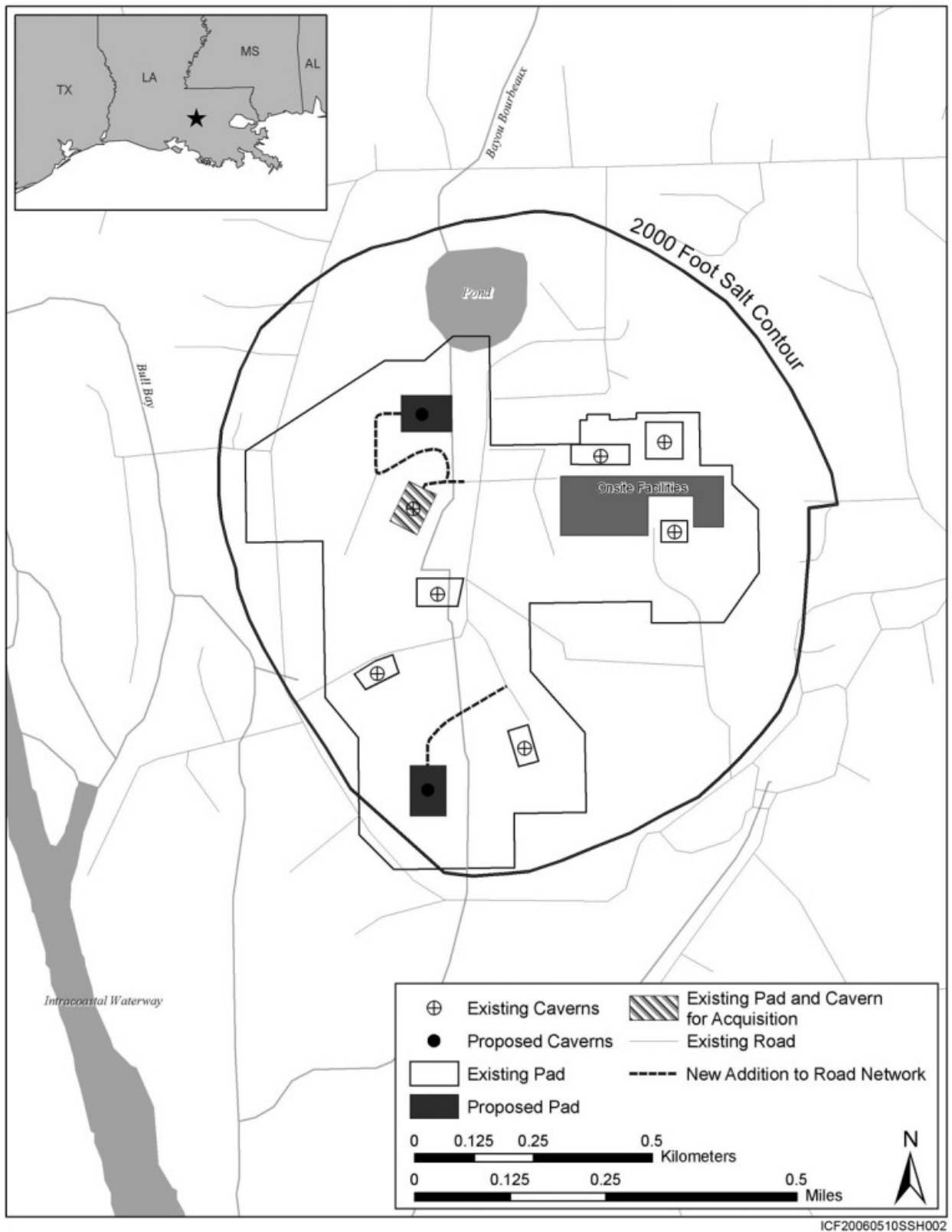


**Figure 2.5.1-1: Location of Proposed Bayou Choctaw Expansion Site**



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**Figure 2.5.1-2: Layout and Proposed Expansion for Bayou Choctaw Storage Site**



and acquired caverns would be connected to the existing RWI, crude oil distribution, electrical, storage facility control and monitoring, and brine disposal systems. The current RWI system's capacity would be increased to 0.615 MMBD to accommodate increasing the oil drawdown rate to 0.590 MMBD. The impellers on the RWI pumps would be refitted and 750-horsepower drivers would be added to the system.

The brine disposal system also would be upgraded by installing 3,000 feet (900 meters) of brine pipeline to six new injection wells located 3,000 feet (900 meters) south of the existing brine injection well area on a 96-acre (39-hectare) site to meet the increased storage capacity at the site. The system upgrades are designed to meet the increased brine disposal requirements during cavern development, drawdowns, and filling events. The current brine disposal rate is limited by underground injection permits to 0.11 MMBD; therefore, increasing the storage capacity would not increase the brine disposal rate. A new brine disposal filtration system would be installed. The existing crude oil distribution system would meet all of the drawdown requirements for an expanded site. No offsite oil pipeline enhancements would be required. Onsite expansion would include installation of new 12-inch (30-centimeter) pipelines connecting the expansion caverns to the existing crude oil distribution system.

General construction on the site would include a new heat exchanger to accommodate the increased flow rate, new 12-inch (30-centimeter) brine headers, 16-inch (41-centimeter) crude oil headers, and 4-inch (10-centimeter) string flush piping with all necessary block and control valves. New 12-inch (30-centimeter) firewater pipelines with hydrants and monitors would be installed. A 0.5-mile (0.7-kilometer) access road would be built for the new caverns, an existing road would be upgraded, and a replacement bridge constructed.

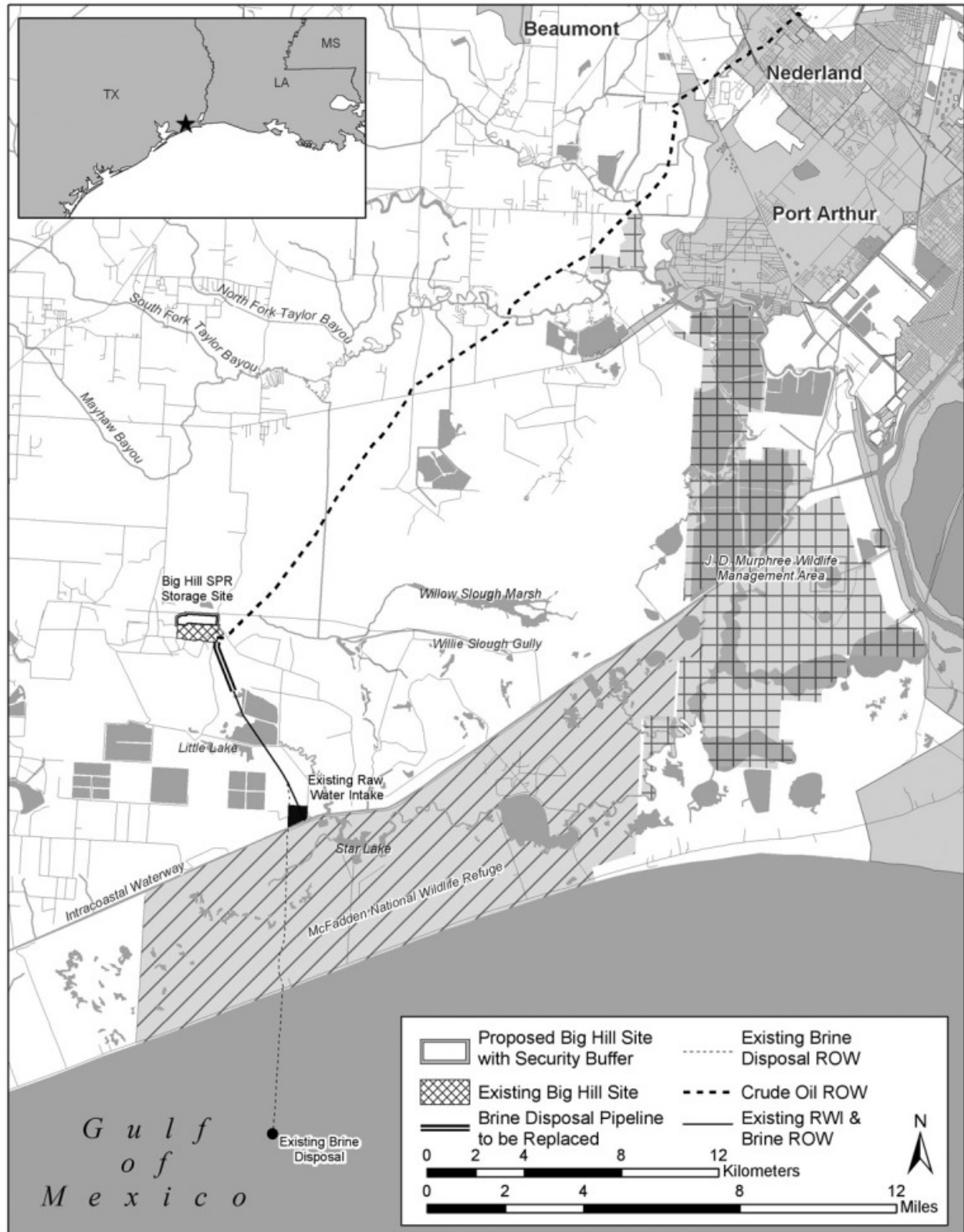
### **2.5.2 Big Hill Expansion Site**

Big Hill is located in Jefferson County, TX, 17 miles (27 kilometers) southwest of Port Arthur, as shown in figure 2.5.2-1. The existing site occupies approximately 250 acres (101 hectares). It is 70 miles (113 kilometers) east of Houston. The surrounding area is predominantly rural with agricultural production as the primary land use. Oil and gas production is the other major economic activity in Jefferson County.

The existing Big Hill facility, illustrated in figure 2.5.2-2, consists of 14 crude oil storage caverns with a combined capacity of 170 MMB and a drawdown rate of 1.1 MMBD, a brine disposal system, an RWI system, and a crude oil distribution system. The site also has various support facilities including a heliport; diesel oil storage; various laydown yards; maintenance yard; and control, service, and administration buildings. The caverns are located in the center portion of the salt dome and are arranged in two rows of five caverns and one row of four caverns. Each cavern is located at a depth of 2,200 to 4,200 feet (670 to 1,300 meters) and has a maximum width of about 200 feet (61 meters).

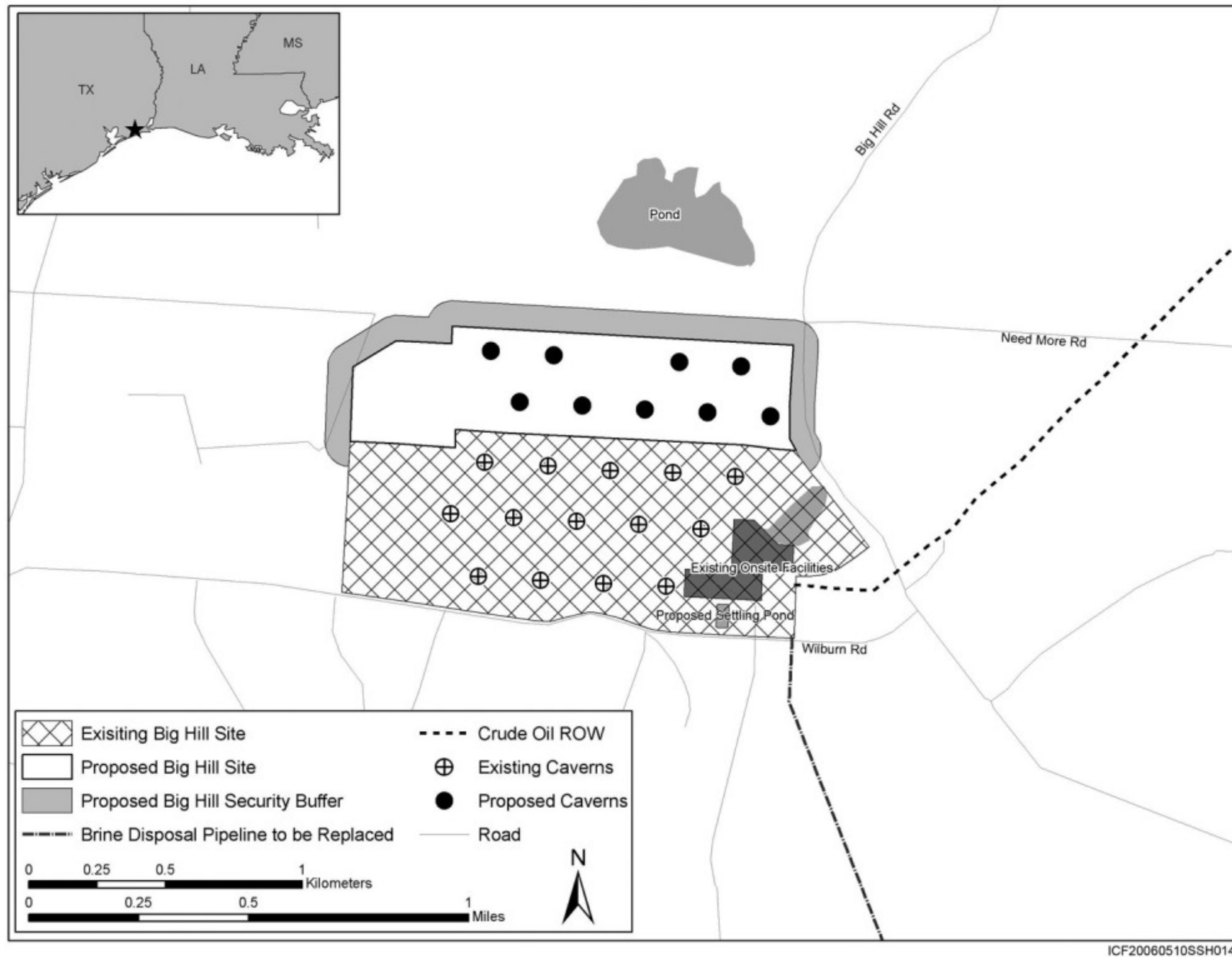
DOE proposes to expand the Big Hill facility by up to 108 MMB of new storage capacity and increase the drawdown rate to 1.5 MMBD. However, DOE may expand the existing Big Hill SPR facility by 72, 80, 96, or 108 MMB by constructing 6, 7, 8, or 9 new 10 or 12 MMB caverns. For each expansion scenario, DOE would acquire approximately 147 acres (60 hectares) of land directly north of the existing site. An overview of the 108 MMB expansion is shown in figure 2.5.2-2. A security buffer of 59 acres (24 hectares) would be created by clearing an area 300 feet (91 meters) beyond an outer security fence on this acquired land. This area would be cleared of undergrowth, scrub, shrub, and any trees, and would be managed as an open field. The area where the expansion would take place is currently owned by Sabine Pass Terminal, although British Petroleum retains mineral rights. Neither of these companies currently has any operations on the site. Unocal has developed two 0.5-MMB liquid petroleum gas storage caverns just north of the proposed storage area. There are no other operators on the Big Hill salt dome.

Figure 2.5.2-1: Location and Pipelines of Proposed Big Hill Expansion Site



ICF20060504SSH015

Figure 2.5.2-2: Layout and Proposed Expansion for Big Hill Storage Site



Because Big Hill is an SPR facility, any site expansion could take advantage of the existing infrastructure. Nevertheless, the increased storage capacity and drawdown rate would require that all of the major systems be expanded or upgraded. Construction necessary to expand the facility would include preparing the site, solution mining the new storage caverns, constructing a new crude oil distribution pipeline, upgrading the existing brine disposal pipeline, and upgrading the RWI pumps. The existing anhydrite-settling pond, which is 55 to 65 percent full of solids, could not handle the increased brine flow from the new caverns, and a new settling pond would be added. The replacement pond would be constructed adjacent to the existing pond. Because the new pond would be connected to the existing underground pipeline network, construction would be limited primarily to the pond itself.

The new caverns would tie into the existing RWI system, with only minor upgrades necessary. New RWI pumps and five additional raw water injection pumps would be installed to handle the increased demand for raw water.

The existing brine disposal pipeline would have adequate capacity to handle the increased flow, but approximately 7,000 feet (2,100 meters) of the existing line would need to be replaced because of corrosion from existing activities. To meet the new drawdown rate of 1.5 MMBD, DOE would construct a 30-inch (76-centimeter), 23-mile (40-kilometer) crude oil pipeline to the Sun terminal at Nederland, TX. This pipeline would parallel the existing pipeline ROW. Figure 2.5.2-1 shows the pipeline route. DOE would install two crude oil injection pumps and motors at Big Hill. Expansion also would require installing security measures, as outlined in section 2.3.5.

### **2.5.3 West Hackberry Expansion Site**

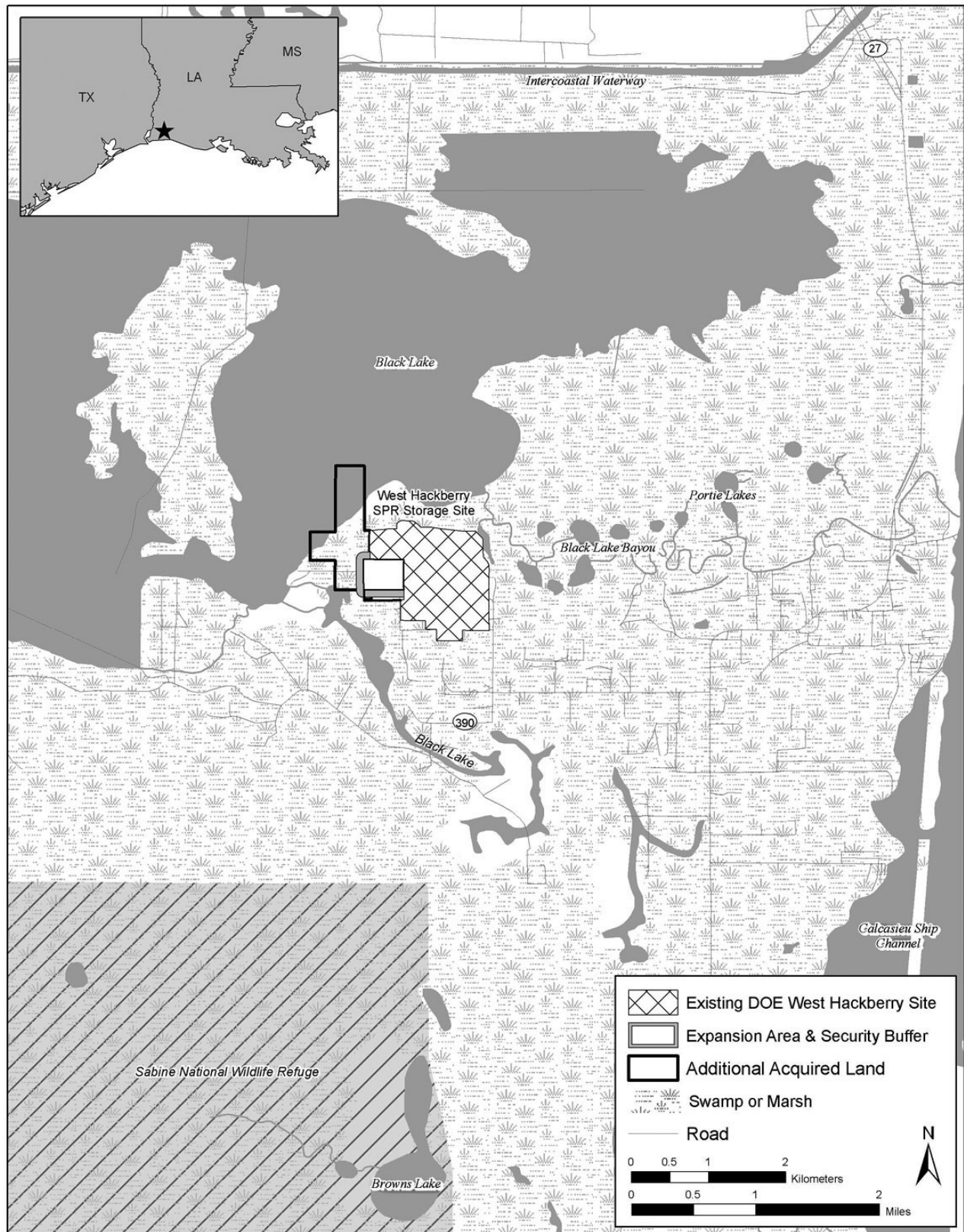
West Hackberry occupies a 565-acre (228.6 hectares) site in Cameron and Calcasieu Parishes in southwestern LA, as shown in figure 2.5.3-1. The site is located approximately 20 miles (32 kilometers) southwest of the city of Lake Charles and 16 miles (26 kilometers) north of the Gulf of Mexico. Hackberry, a local unincorporated town of approximately 1,500 people, and the Calcasieu ship channel, are approximately 4 miles (6.4 kilometers) east of the site. The Sun terminal in Nederland, TX, which serves as the oil supply and distribution terminal, is about 40 miles (64 kilometers) west of the site.

The SPR storage facility consists of 22 caverns with a combined capacity of 227 MMB (see figure 2.5.3-2). Raw water is supplied from the ICW, approximately 4 miles (6.4 kilometers) north of the SPR storage site. The raw water pipeline crosses Black Lake en route from the RWI structure to the storage facility. The maximum drawdown rate is 1.3 MMB. The site is connected to the Sun terminal through a 43-mile (69-kilometer) crude oil pipeline and to the Lake Charles meter station through a 14-mile (23-kilometer) crude oil pipeline.

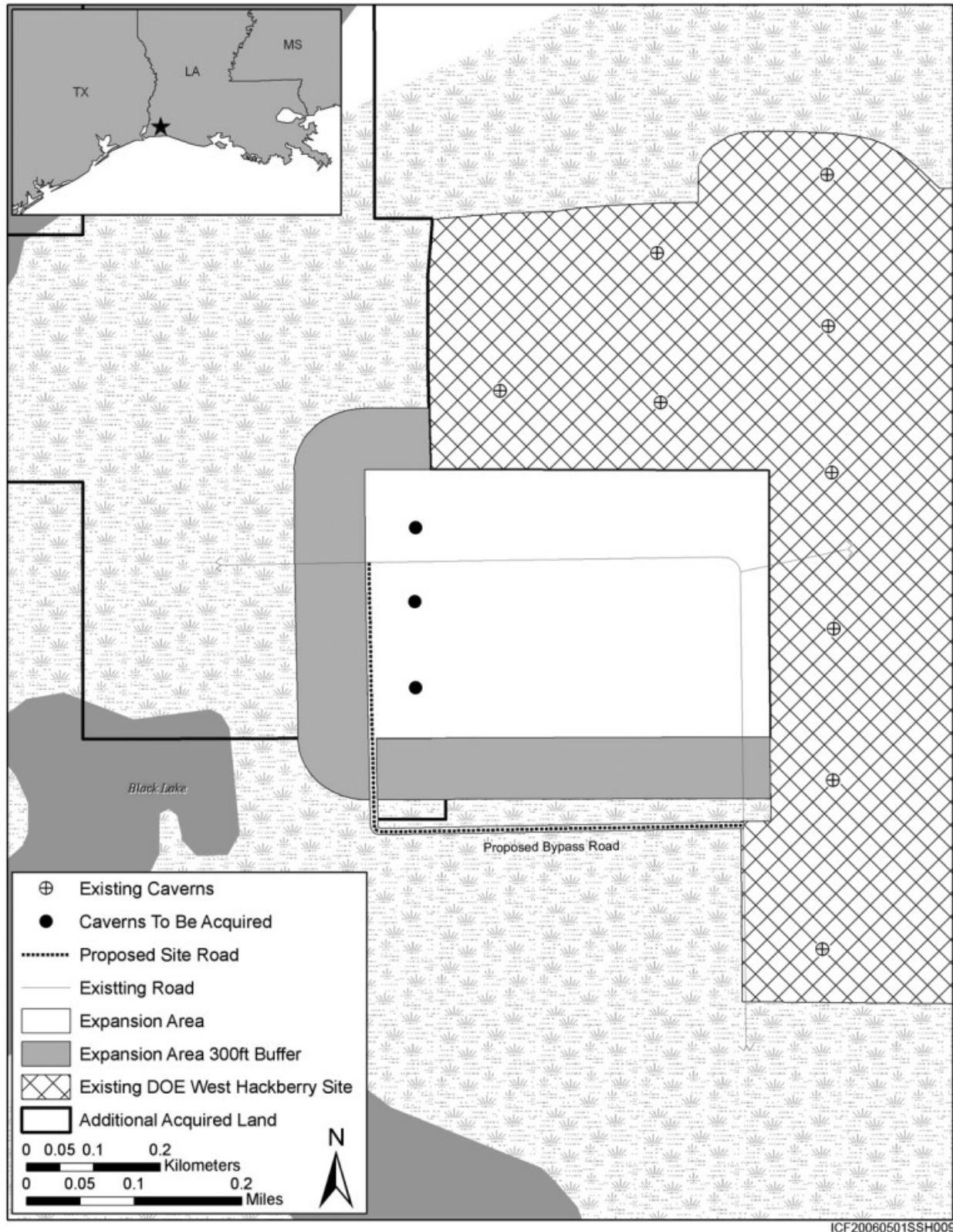
DOE would acquire three privately owned existing 5-MMB capacity caverns that are located adjacent to the existing site. These three existing caverns would add 15 MMB of storage capacity and 53 acres (21 hectares) to the existing SPR site. In addition, DOE would purchase 240-acres (97-hectares) of abutting land to the west, as illustrated in figure 2.5.3-1. The maximum drawdown rate would remain at its current rate of 1.3 MMBD. The caverns currently are not in use; they are filled with brine. They are arranged in one row that runs roughly north-south on the west side of the existing facility. Expansion would not require significant upgrades to the RWI facility, crude oil distribution capabilities, or the brine disposal system. Only minor construction would take place to connect the acquired caverns to the SPR storage site. An overview of the site and the expansion area is shown in figure 2.5.3-2.

New onsite pipelines would connect the acquired caverns to the existing onsite water, brine, and crude-oil systems. The existing electrical system and the existing storage facility control and monitoring system would be adequate to handle the increased demand created by the expansion. Both systems would be

**Figure 2.5.3-1: Location of Proposed West Hackberry Expansion Site**



ICF20060411SSH010

**Figure 2.5.3-2: Layout and Proposed Expansion of West Hackberry Storage Site**

connected to the expansion site. In addition DOE would construct a 0.5-mile (0.9-kilometer) access road to the acquired caverns. The expansion also would require the installation of security measures, as outlined in section 2.3.5, and would include a 27-acre (11-hectare) security buffer around the acquired caverns.

## **2.6 NO-ACTION ALTERNATIVE**

Under the no-action alternative, the SPR would not be expanded, and it would continue to operate with a 727-MMB capacity. No expansion sites or new sites would be constructed, and DOE would violate the requirements of EPACT.

## **2.7 ALTERNATIVES ELIMINATED FROM DETAILED STUDY**

As required by EPACT Section 303, DOE limited its review of potential new SPR sites and expansion sites to (1) sites that DOE addressed in the 1992 draft EIS and (2) sites proposed by a state where DOE had previously studied a site. DOE eliminated from consideration the alternative locations in Louisiana, Texas, New Mexico, and Virginia identified during public scoping because the sites were not technically feasible and would violate the mandate of EPACT Section 303.

DOE eliminated the alternative of expanding capacity at Bryan Mound, TX, an existing SPR site, because the salt dome has no available capacity for additional storage caverns. While the 1992 draft EIS addressed the potential new salt dome sites at Cote Blanche, LA, and Weeks Island, LA, DOE's preliminary review of these sites for this draft EIS concluded that they are no longer viable due to the sale of the DOE's Weeks Island crude oil pipeline and its subsequent conversion to natural gas transmission.

In addition, DOE considered several alternative pipeline alignments for most storage sites to minimize impacts to wetlands. Other alternative pipeline alignments that DOE eliminated from detailed consideration because they would affect more wetlands are described in Appendix B Floodplains and Wetlands Assessment. DOE also considered, but dismissed from detailed analysis the alternative of using water from the ICW for the Richton storage site because of the significant length of new pipeline (over 100 miles [161 kilometers]) that would be required.

## **2.8 COMPARISON OF ALTERNATIVES**

CEQ NEPA regulations (40 CFR Part 1500.2(e)) direct Federal agencies to use the NEPA process to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment. Analyses of alternatives are the heart of an EIS. CEQ regulations (40 CFR 1502.14) state:

*Based on the information and analysis presented in the sections on the Affected Environment (Sec. 1502.15) and the Environmental Consequences (Sec. 1502.16), it [an EIS] should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public.*

The following sections discuss the potential environmental impacts of the proposed seven alternatives, including the no-action alternative, across 10 resource areas:

- Environmental risks and public and occupational safety and health;
- Land use;
- Geology and soils;

- Air quality;
- Water resources;
- Biological resources;
- Socioeconomics;
- Cultural resources;
- Noise; and
- Environmental justice.

Table 2.8-1, at the end of the chapter, describes the potential impacts for each alternative with three expansion sites, which would be Bayou Choctaw, Big Hill, and West Hackberry, and for the no-action alternative. (See table 2.2.3-1 for further detail on the alternatives.)

Table 2.8-2, at the end of the chapter, addresses the difference between the alternatives in the first table, which have three expansion sites, and the remaining alternatives, which have just two expansion sites. In other words, the second table focuses on the differences associated with not expanding West Hackberry and increasing the expansion capacity at Big Hill. (It does not address Bayou Choctaw because the same expansion capacity would be developed under both sets of alternatives.)

The second table does not address the Clovelly alternative because Clovelly (without Bruinsburg) would be developed only with three expansion sites. The second table also does not repeat the discussion of the no-action alternative.

### **2.8.1 Environmental Risks and Public and Occupational Safety and Health**

For this analysis, DOE considered risk as both the likelihood (or chance) of occurrence and the potential consequences. While accidental releases can occur during long-term storage, the risk of an oil spill generally is dominated by transfer activities. Furthermore, the maximum quantity filled occurs with the initial fill. This initial-fill activity also represents the greatest incremental chance of spills of all the potential for a spill associated with current imports into the United States because subsequent drawdowns and refills would just replace a transfer of oil from interrupted imports. This analysis focuses on the likelihood of an oil spill during initial-fill activities.

The risks from oil spills would be similar across alternatives because the risks are primarily a function of the amount of oil transferred into SPR caverns, which would be similar across alternatives. The predicted number of oil spills would be approximately 16 spills during initial site fill. Based on historical spill statistics, the predicted oil spills would likely be low volume (less than 100 barrels).

The potential consequences of such infrequent, low-volume, accidental releases of oil would be minor. The releases generally would result in localized soil contamination at the storage sites and terminal locations, which would be contained and cleaned up. Elevated concentrations of oil constituents occurring in the water column and on the water surface immediately after a spill would decrease over time because of dispersion, dilution, and degradation. The rate of concentration decline would depend on the size and flushing rate of the water body affected, as discussed below. Although there is a low probability of an accidental brine discharge, the consequences of a release could be significant if the release was large and/or it migrated into a sensitive aquatic system or plant community. A large release of oil could result in mortality for plants and animals through chemical toxicity, physical smothering, respiratory interference, food and habitat loss, and inhalation or ingestion. Impacted communities can take decades to recover from a large release. A release of brine could cause significant and sometimes fatal physiological trauma to plants and animals, especially bird eggs, fish eggs, and fish larvae. While the spills would result in some air contaminants, the contaminants would be released so infrequently and

in such small quantities that they would be readily dispersed in the atmosphere and would have little effect on ambient air quality along site boundaries.

The brine spill risk also would be low. The risks would be similar across alternatives because the risks are primarily a function of the amount of brine disposed of, which would be similar across alternatives. The total number of brine spills predicted would be 96 to 103 for each alternative. Based on historical data, however, these spills would mostly be of low volume (less than 50 barrels). Higher-volume brine spills, while possible, are very unlikely based on SPR experience. Unless the spills were large or sustained, neither of which is predicted, the brine contaminants would be diluted and dispersed into the surrounding area and waterbodies by rain; soils and vegetation affected by changes in the mineral concentrations would quickly recover; and any impacts of changes in mineral concentrations on shallow groundwater and air quality would be small. While unlikely, a large discharge of brine into a sensitive aquatic system or plant community could have significant effects as discussed above.

The risk of chemical spills and fire would be small and similar across alternatives given the identical activities for each alternative, excluding the no-action alternative. The occupational injuries also would be small and similar across alternatives. For example, the rate of lost workdays due to injuries at new and expanded sites would be similar to the rate at existing SPR sites, which is 0.83 workdays per 200,000 worker hours. This rate is much lower than the Bureau of Labor Standards average of 5.3 workdays per 200,000 worker hours.

## **2.8.2 Land Use**

The analysis of land use addresses land-use conflicts, visual resources, prime farmland, and coastal zone management. Each of these four topics is addressed below.

### **Possible Land Use Conflicts**

The regulations for implementing the National Environmental Policy Act require agencies to discuss possible conflicts between the proposed action and the objectives of Federal, state, and local land use plans, policies, and controls (40 CFR 1502.16(c)). Each of the proposed alternatives would require the commitment of land for the development and operation of new and expansion sites and their infrastructure. The total area would range from a high of 4,494 acres (1,820 hectares) for the Richton alternative with three expansion sites to a low of 693 acres (281 hectares) for Clovelly. Tables 2.8-1 and 2.8-2 identify the area required for the other alternatives.

The proposed new storage sites and their infrastructure generally would be located in rural areas where they would not conflict with surrounding land uses. At Clovelly and the expansion sites, the new facilities would be similar to existing facilities and therefore land use would not change substantially. No substantial land-use conflicts would arise for the Chacahoula and Clovelly alternatives. For the other alternatives, the following conflicts would arise for their infrastructure development:

- For the Bruinsburg 160 MMB alternative, the crude oil pipeline to Peetsville, MS, would cross the Natchez Trace National Scenic Trail and the Natchez Trace Parkway along an existing power line ROW. (All proposed pipelines would be underground except where they cross levees.) The expansion of the ROW would require clearing vegetation and would slightly expand the existing land use of the ROW. The same pipeline would travel through private property contained within the proclamation boundary of the Homochitto National Forest for 6.8 miles (11 kilometers). (The proclamation boundary defines an area where the Forest Service may purchase land from willing sellers to expand the forest without further Congressional authorization.) About 5.6 miles (9 kilometers) would parallel an existing highway in a new corridor. While this would be a new land

use, other land uses in the new ROW are unlikely to be substantively affected. The remainder of the pipeline through the proclamation area would be in an existing ROW.

- For the Clovelly 80 or 90 MMB/Bruinsburg 80 MMB alternatives, the crude oil pipeline to Jackson, MS, would cross the Natchez Trace National Scenic Trail and Natchez Trace Parkway along an existing power line ROW, as discussed above. No pipeline for this site would cross the Homochitto National Forest proclamation area for these alternatives.
- For the Richton alternative, the pipeline to Liberty, MS, would cross the Percy Quin State Park for about 0.5 miles (0.7 kilometers) in a new ROW. If this alternative is selected, DOE would work with the State of Mississippi to re-align the pipeline to cross the park in an existing ROW where feasible.
- For the Stratton Ridge alternative, approximately 3 miles (4.8 kilometers) of the RWI pipeline, brine disposal pipelines, and two power lines would cross the Brazoria National Wildlife Refuge and a privately owned land in the refuge's proclamation area in the same new ROW. In addition, 4.7 miles (7.6 kilometers) of the crude oil pipeline would cross the refuge in an existing pipeline ROW. If this alternative is selected, DOE would work with the U.S. Fish and Wildlife Service (USFWS) to reduce these land use conflicts, such as by placing the power line underground.

### **Visual Resources**

Construction activities at new SPR storage sites would result in temporary visual impacts and long-term changes in the existing landscape. These new facilities would appear industrial in nature and would conflict with surrounding natural vegetation. The impacts, however, would be minor because the new facilities would not be visible from residential or commercial areas and the sites would have limited public access. Expansion of the existing SPR facilities would not provide a large visual contrast with the existing landscape because of the existing industrial land use at these sites.

The construction of pipelines, power lines, and other infrastructure would have only minor visual impacts, with three exceptions:

- The development of the Bruinsburg 160 MMB or 80 MMB site would have a visual impact on the historic Civil War landscape, as noted below in section 2.8.8.
- As discussed under land use conflicts above, the ROWs for several alternatives would cross a national parkway, national scenic trail, national forest proclamation area, state forest, or national wildlife refuge. These ROWs would affect the views in these corridors. DOE would attempt to preserve the natural landscapes in these settings by using existing ROWs where feasible, placing pipelines underground, and otherwise working with other agencies to minimize the impacts.
- For the Stratton Ridge alternative, the RWI would be located along the shoreline of the ICW across from the border of the Brazoria National Wildlife Refuge. Recreational sightseers visiting the refuge might be sensitive to change in the visual quality, even though the RWI would be outside the refuge.

### **Farmland**

SPR development activities would cause farmland conversion by shifting the use of land to nonfarm uses. Any prime or unique farmlands located on proposed SPR storage sites, RWI facilities, and oil distribution terminals would be permanently converted to nonfarm uses because the potential use of that land for agricultural purposes would be lost. The construction of pipelines and power lines would temporarily

prohibit agricultural use of farmland within the construction easement during the construction period of up to six to ten weeks at any specific location.

To assess these potential impacts, DOE, in consultation with the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), scored all of the individual sites and all of the alternatives using the farmland conversion impact rating. This scoring system is specified in the Farmland Protection Policy Act regulations (7 CFR Part 658). It considers a wide variety of factors related to potential farmland conversion impacts, including the amount of prime or unique farmland that would be converted; the amount of statewide and locally important farmland; the use of the land and nearby land; the distance to urban built-up areas and urban support services; on-farm investments; and compatibility with existing agricultural use. Under the regulations, "sites receiving a total score of less than 160 need not be given further consideration for protection and no additional sites need to be evaluated" (40 CFR 658.4(c)(2)). While all alternatives would affect farmlands, each alternative had a score below 160 out of 260 possible points and therefore needs not be given further consideration for protection.<sup>1</sup>

### **Coastal Zone Management**

The Bruinsburg, Chacahoula, Richton, and Bayou Choctaw sites are outside the coastal zone, but some of their associated infrastructure, as well as the expansion site and infrastructure of Big Hill and the expansion site of West Hackberry would be in coastal zones. The Clovelly and Stratton Ridge sites also are in the coastal zone. The Clovelly 80 MMB/Bruinsburg 80 MMB alternative and the Clovelly 90 MMB/Bruinsburg 80 MMB alternative would have the same components in the coastal zone as the individual Clovelly and Bruinsburg alternatives. DOE consulted with the coastal zone management agencies for all three states regarding compliance with the Federal Coastal Zone Management Act. The agencies preferred that DOE coordinate its consistency determination for the selected alternative through the U.S. Army Corps of Engineers (USACE) during the Section 404 wetlands permitting process. USACE would then forward the determination to the coastal zone management agencies, which would conduct a consistency review and either object or concur with DOE's determination. This process satisfies the requirements of the Federal Coastal Zone Management Act.

#### **2.8.3 Geology and Soils**

Local subsidence, limited to the area above the proposed storage caverns, would range from about 2 to 6 feet (0.7 to 2 meters) over 30 years for any of the alternatives. These depressions on dry land might cause minor ponding in the area overlying the caverns. Depressions in wetland areas would increase the zone of saturation closer to the surface or the depth of any standing water. The new caverns would be designed to not jeopardize the structure or integrity of existing caverns on the salt domes.

#### **2.8.4 Air Quality**

The proposed action would generate low emissions of criteria pollutants. Emissions levels would be below levels of concern, including below conformity determination thresholds in the ozone nonattainment areas at Bayou Choctaw, Big Hill, and Stratton Ridge. At the Stratton Ridge site, the conformity review conducted for this draft EIS estimates that the maximum emissions of volatile organic compounds would be slightly below the threshold that triggers a full conformity determination. Thus, if the Stratton Ridge

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<sup>1</sup> The location of some of the proposed sites and their infrastructure changed slightly since DOE consulted with NRCS. Additional consultations to incorporate the new information were not feasible for inclusion in this draft EIS. Nonetheless, the nature of these minor changes would not increase the score for any site and its infrastructure to be greater than 160 points.

site were selected, DOE would conduct an additional conformity review using the final site design to determine if the current estimate is sufficiently conservative and would not be exceeded.

The greatest source of greenhouse gas emissions for SPR expansion are carbon dioxide associated with construction equipment and motor vehicles and methane from cavern leaching. During construction, the maximum annual average greenhouse gas emissions associated with any alternative would be less than 0.22 million tons of carbon dioxide equivalents. The emissions during SPR operations would be smaller, about one-third as much as during construction.

### **2.8.5 Water Resources**

#### **Surface Water**

The proposed facilities would withdraw water from nearby surface water bodies for use in cavern solution mining. Two of the proposed new sites (Chacahoula and Stratton Ridge) and two expansion sites (Big Hill and West Hackberry) would withdraw water from the ICW. The proposed new Bruinsburg site would withdraw water from the Mississippi River. Two new sites (Clovelly and Richton) and one expansion site (Bayou Choctaw) would withdraw water from local surface water bodies other than the ICW. With the exception of the Richton alternative, the water withdrawal would represent a small amount of the average available water from river flows or water bodies for all alternatives except the Richton alternative because the rivers and water bodies are large. For the new Richton site, the flow rate of the Leaf River is highly variable and there would be a potential for withdrawing a significant fraction of the total river flow during drought periods. This withdrawal could exceed the minimum in-stream flow levels established by the Mississippi Department of Environmental Quality during periods of low flow in the Leaf River.

Brine from the solution mining of the salt caverns or from filling caverns with oil would be discharged into the Gulf of Mexico from the proposed SPR facilities, with the exception of Bruinsburg, Bayou Choctaw, and West Hackberry, where brine would be injected into deep subsurface aquifers via injection wells. All of the proposed brine diffuser locations in the Gulf of Mexico would be in waters of similar depths along the coastline (i.e., 30 feet [9 meters]), with placement at a depth that does not affect navigation. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand for all alternatives with brine discharge into the Gulf of Mexico) would occur from the discharge, but the increase would be within natural salinity variation. However, brine discharged through the proposed Chacahoula diffuser may tend to pool at the sea bottom due to flow restrictions. The bottom of the Gulf of Mexico slopes gently seaward at all of the proposed diffuser locations except for Chacahoula, which is located in close proximity to a shoal area (Ship Shoal). Brine plume movement at Chacahoula would be restricted due to the bathymetry resulting from the presence of the shoal area.

All alternatives would involve the construction of multiple pipelines that would cross a variety of surface water bodies. The construction activities would cause temporary and minor erosion and sedimentation. Only the Bruinsburg, Richton, and Stratton Ridge pipelines would cross areas with state programs (e.g., wellhead protection areas) to protect against contamination of particular drinking water (surface or groundwater) sources. Even though the Bruinsburg, Richton, and Stratton Ridge alternatives involve pipelines that would pass through protected drinking water areas, no alternative would be likely to contaminate a drinking water source.

The effects of a brine or oil discharge into surface water were discussed above under Environmental Risks and Public and Occupational Safety and Health.

## **Groundwater**

As previously mentioned, brine from Bruinsburg, Bayou Choctaw, and West Hackberry would be injected into deep saline aquifers via injection wells. West Hackberry would use an existing injection system; Bayou Choctaw would use existing and proposed new injection wells; and at Bruinsburg, DOE would construct new injection wells.

The potential for brine to leak into shallow water source aquifers is very low for all sites. Brine injection wells would be sealed and pressure tested to assure that leakage would not occur. DOE also would implement a shallow groundwater-monitoring program at each site to ensure protection of groundwater quality. Additionally, each site has confined aquifers that are separated by impermeable strata, so impacts to groundwater associated with the disposal of brine by deep well injection would be minimal. At Bayou Choctaw, the proposed receiving formation for injection of brine is below any aquifers containing fresh or slightly saline water. The West Hackberry expansion would use the existing SPR brine disposal facilities, which DOE has previously assessed and determined would not result in adverse impacts to groundwater. Based on well logs at Bruinsburg, DOE is uncertain whether the Sparta formation alone would have adequate capacity to handle the proposed brine injection volumes and rates; therefore, if this alternative is selected, DOE would consider developing injection wells in two formations. Brine injected into these aquifers at Bruinsburg would travel further downgradient into increasingly saline portions of the aquifers, and away from the portions of the aquifers that constitute current or potential sources of fresh water.

## **Floodplains**

A substantial portion of the proposed storage sites and associated infrastructure of each alternative would be located in the 100-year and 500-year floodplain. Between 56 acres (23 hectares) under the Clovelly alternative and 276 acres (112 hectares) under the Bruinsburg alternative of the 100-year floodplain would be permanently affected. Between 27 acres (11 hectares) under the Chacahoula, Clovelly, and Richton alternatives and 216 acres (87 hectares) under the Stratton Ridge alternative of the 500-year floodplain would be permanently affected. The amount of onsite construction would vary by site, with the greatest amount of floodplain disturbance at Stratton Ridge and Bruinsburg. Offsite pipeline construction would affect floodplains only during construction, and areas would be brought back to grade following construction. Pipeline construction associated with the Chacahoula project crosses the largest area of floodplains.

Because most of the infrastructure on the affected floodplains would be built below ground, the impacts would be lessened. The main impacts on flood storage and flooding attenuation would result from constructing some aboveground structures and placing fill at the new cavern facilities at Chacahoula, Bayou Choctaw, Stratton Ridge, and Big Hill. These fill areas, however, would be insignificant in comparison the total areas of the floodplains where they are located. The Chacahoula, Richton, Stratton Ridge, and Big Hill sites are located in floodplains that extend over hundreds of acres in coastal basins. The Bruinsburg and Bayou Choctaw sites also are located in an extensive floodplain area associated with the Mississippi River. Thus, fill areas developed as part of the proposed action at these sites would have insignificant impact on the flood storage capacity or hydraulic function of the related floodplains.

DOE would comply fully with applicable local and state guidelines, regulations, and permit requirements regarding floodplain construction. In general, DOE would be required to evaluate the impact of placing fill or structures in the 100-year floodplain and 500-year floodplain and to demonstrate that the proposed fill/structures would not increase the base flood elevation.

Based on the factors discussed above and in detail in sections 3.6 and in appendix B, DOE expects that overall impacts to floodplain hydraulic function, and to lives and property, would not be significant.

## 2.8.6 Biological Resources

### Plants, Wetlands, and Wildlife

Each alternative would result in the clearing, grading and filling of a variety of upland and wetland communities. For each alternative, the ROWs would result in temporary impacts on wetlands within the construction easement and permanent impacts within the permanent ROW from converting forested and scrub-shrub wetland communities to emergent wetlands. For all filling and permanent conversion of wetlands, DOE would complete a wetland delineation, secure a jurisdictional determination, and secure Clean Water Act Section 404/401 permits from USACE for all impacts to jurisdictional wetlands. DOE would prepare a wetland compensation plan to mitigate the impacts to jurisdictional wetlands, as described in appendix B, section B.4.

Table 2.8-3 summarizes the wetland impacts by alternative. As presented in table 2.8-3, fill includes the dredging or filling of a wetland; conversion is the conversion of one wetland type to another type (e.g., forest wetlands to emergent wetlands), and temporary disturbance includes short-term construction activities in wetlands.

**Table 2.8-3: Impacts on Wetlands**

Alternative	Storage and Expansion Sites and Ancillary Facilities		All ROWs	
	Filled Wetlands Acres	Permanent Conversion Acres	Temporary Easement Acres	Permanent Easement Acres
Bruinsburg	150	25	306	211
Chacahoula	175	220	1,222	867
Clovelly	49	7	122	60
Clovelly 80 MMB/ Bruinsburg 80 MMB	86	23	398	253
Clovelly 90 MMB/ Bruinsburg 80 MMB	86	23	398	251
Richton	90	9	907	527
Stratton Ridge	277	80	288	181

1 acre = 0.405 hectares

The Clovelly alternative would affect the fewest acres of wetlands because the new site would be developed at an existing crude oil storage and distribution facility and no new off-site infrastructure or pipelines would be required. The relative impacts on wetlands (fill, conversion, and temporary disturbance) associated with the Clovelly 80/Bruinsburg 80 MMB, Clovelly 90/Bruinsburg 80 MMB, and Bruinsburg 160 MMB alternatives would be approximately the same compared to each other. Up to 39 acres of relatively rare and ecologically important bald cypress forested wetlands would be filled or converted at Bruinsburg under the Clovelly 80 MMB/Bruinsburg 80 MMB, the Clovelly 90 MMB/Bruinsburg alternatives, and up to 103 acres under the Bruinsburg alternative. The impacts on wetlands under the Stratton Ridge alternative would involve filling and converting up to 258 acres of relatively rare and ecologically important bottomland hardwood forest at the Stratton Ridge site.

The Richton alternative would result in almost double the amount of wetland impacts from fill, conversion, and temporary disturbance (over 1,500 acres [619 hectares]) than the Bruinsburg alternative.

The majority of the wetland impacts associated with the Richton alternative would result from the long ROWs, over 200 miles, and the associated impacts from the clearing within the ROW. The Chacahoula alternative would have the most acres of wetlands affected by fill, conversion, and temporary disturbance (over 2,400 acres [970 hectares]). Up to 339 acres (137 hectares) of relatively rare and ecologically important bald cypress forested wetlands would be filled or converted at Chacahoula, and the majority of each ROW would pass through the extensive wetlands located throughout southern Louisiana. Appendix B presents a detailed discussion of the wetlands associated with each site and alternative.

The effects of a brine or oil discharge into surface water was discussed above under Environmental Risks and Public and Occupational Safety and Health.

### **Threatened and Endangered Species**

With the exception of the Clovelly alternative, where no Federally listed threatened, endangered, or candidate species would be affected, each alternative may affect one or more Federally listed species. Two aquatic species may be affected under the Bruinsburg alternative; two terrestrial species may be affected under the Chacahoula alternative; and a single aquatic species may be affected under both the Clovelly 80 MMB/Bruinsburg 80 MMB alternative and the Clovelly 90 MMB/Bruinsburg 80 MMB alternative. Two terrestrial and three aquatic species may be affected under the Richton alternative, and a single terrestrial species may be affected under the Stratton Ridge alternative. The following summarizes the impacts by alternative:

#### Bruinsburg

- Fat Pocketbook Mussel, Federally endangered, may be affected by the Bruinsburg ROW in-stream construction in Coles and Fairchild creek.
- Pallid Sturgeon, Federally endangered, may be affected by the in-river construction and operation of the Bruinsburg RWI structure.

#### Chacahoula

- Bald Eagle, Federally threatened, may be affected by the development and operation of the Chacahoula site and construction along the Chacahoula ROWs. Potential foraging, roosting, and nesting habitat may be impacted.
- Brown Pelican, Federally endangered, may be affected by the construction along the Chacahoula ROW to LOOP. Roosting habitat may be affected.

#### Clovelly

- No Federally listed species would be affected.

#### Clovelly 80 MMB/Bruinsburg 80 MMB

- Pallid Sturgeon, Federally endangered, may be affected by the in-river construction and operation of the Bruinsburg RWI structure.

Clovelly 90 MMB/Bruinsburg 80 MMB

- Pallid Sturgeon, Federally endangered, may be affected by the in-river construction and operation of the Bruinsburg RWI structure.

Richton

- Gopher Tortoise, Federally threatened, may be affected by the construction along the Richton ROWs, which may result in a loss of habitat and individuals.
- Black Pine Snake, Federal candidate, may be affected by the construction along the Richton ROWs, which may result in a loss of habitat and individuals.
- Yellow Blotched Map Turtle, Federally endangered, may be affected by the in-water construction and operation of the Richton RWI structure. A loss of habitat, and impingement of and entrainment of early life stages or altering the hydrologic regime in the Leaf River may occur.
- Gulf Sturgeon, Federally endangered, may be affected by the in-water construction and operation of the Richton RWI structure. The RWI may adversely affect designated critical habitat and may adversely affect the population through impingement of and entrainment of early life stages or altering the hydrologic regime in the Leaf River.
- Pearl Darter, Federal candidate, may be affected by the in-water construction and operation of the Richton RWI structure. The RWI may result in a loss of habitat, impinge and entrain pearl daters in early life stages, or alter the hydrologic regime in the Leaf River.

Stratton Ridge

- Bald Eagle, Federally threatened, may be affected by the development and operation of the Stratton Ridge site. Construction along the Stratton Ridge ROWs may affect potential foraging, roosting, and nesting habitat.

In accordance with Section 7 of the Endangered Species Act, DOE has consulted with the USFWS and has identified the Federally listed species that the proposed action would not affect and the Federally listed species that the proposed action may affect. Upon the selection of an alternative, DOE would continue consultations with USFWS in accordance with Section 7.

**Special Status Area**

The Chacahoula alternative would not affect special status areas. The Bruinsburg, Clovelly 80 MMB/ Bruinsburg 80 MMB, and Clovelly 90 MMB/Bruinsburg 80 MMB alternatives would involve a ROW crossing the Natchez Trace Parkway. In addition, the crude oil ROW to Peetsville under the Bruinsburg alternative would pass through the proclamation area of the Homochitto National Forest. The Clovelly alternative would be located adjacent to the Gulf ICW to Clovelly Hydrologic Restoration project, but would not affect the project. The Richton alternative would involve a ROW crossing the Percy Quin State Park. The Stratton Ridge alternative would involve two ROWs that would pass through the Brazoria National Wildlife Refuge. The impacts on the special status areas would include temporary and permanent changes in the vegetative communities along the construction and permanent ROWs, respectively.

For issues involving the Natchez Trace Parkway, the Homochitto National Forest, the Brazoria National Wildlife Refuge, and Percy Quin State Park, DOE would coordinate with the National Park Service, the U.S. Forest Service, the USFWS, and the State of Mississippi to minimize the impacts to important natural resources.

### **Essential Fish Habitat**

The Chacahoula, Richton, and Stratton Ridge alternatives would require developing new offshore brine disposal systems. The Bruinsburg alternative would use brine injection wells; the Clovelly alternative would use LOOP's existing offshore brine diffusion system; and the Clovelly 80 MMB/Bruinsburg 80 MMB alternative and the Clovelly 90 MMB/Bruinsburg 80 MMB alternative would use a combination of new brine disposal wells at Bruinsburg and the existing offshore brine diffusion system at Clovelly. The underwater construction of an offshore brine pipeline and diffuser would pass through EFH and would temporarily increase suspended sediments and drive marine species from the area. The operation of new brine diffusers plus the existing brine diffusers associated with the Clovelly, Clovelly 80 MMB/Bruinsburg 80 MMB, and Clovelly 90 MMB/Bruinsburg 80 MMB alternatives, as well as the existing offshore diffuser at Big Hill would cause minor increases in the salinity concentrations. The estimated salinity concentrations would increase by up to 4.7 parts per thousand around the diffusers and would affect EFH. Some marine species may avoid the areas with increased salinity concentrations; however, the increase in the salinity concentration would be within the normal salinity concentration range of the Gulf of Mexico. Appendix C discusses the brine plume modeling that DOE completed and appendix E describes the impacts associated with offshore construction and brine diffusion, including brine pooling, on EFH.

### **2.8.7 Socioeconomics**

The proposed action would require a peak construction work force of approximately 230 to 550 employees at the new storage site or combination of sites and infrastructure, plus another 250 to 350 employees for the expansion sites and their infrastructure. The operations workforce would be about 75 to 100 employees at each site and about 25 additional employees at each expansion site. This employment would create positive local economic benefits under all alternatives.

While the proposed storage sites and infrastructure generally are located in or near rural communities, they are close (e.g., 20 to 45 miles [32 to 72 kilometers]) to more populated urban areas. Most workers would come from these relatively close areas. In-migration to the areas near the storage sites would be small relative to the regional population. Thus, the proposed action would create no noticeable increase in competition for labor, traffic, or demand for housing and public infrastructure and services.

### **2.8.8 Cultural Resources**

The proposed action would have the potential to damage or destroy archaeological sites, Native American cultural sites, or historic buildings or structures or to change the characteristics of a property that would diminish qualities that contribute to its historic significance or cultural importance. Native American archaeological sites have been recorded or may be present at most of the proposed new sites, including Chacahoula (underwater), Clovelly (underwater), Richton, Stratton Ridge, and all three proposed expansion sites. The proposed pipeline corridors for Chacahoula are near major streams and tributaries, which are high-sensitivity areas for both Native American archaeological sites and historic sites such as plantations. Also, the Richton and Stratton Ridge pipelines would pass near or through historically and archaeologically sensitive areas. Where possible, damage to these resources would be avoided. Where avoidance is not possible, DOE would undertake mitigation measures, such as, data recovery from an archaeological site or detailed documentation of a building or structure.

SPR development at the Bruinsburg site could result in potential adverse effects on the historic setting of the Civil War landing of the Union Army in Mississippi and an associated route of troop movements in an area that could become eligible for the National Register of Historic Places as a core study area. The floodplain where the Bruinsburg storage caverns would be developed is the site where the Union Army, under General Grant, disembarked after crossing the Mississippi River on April 30, 1863, to begin the invasion of Mississippi that culminated in the surrender of Vicksburg on July 4, 1863. A portion of the Bruinsburg site is likely to contain archaeological remains of troop presence. Remains of at least one of the ships that sank during the invasion are likely to lie northwest of the facility boundary. The historic Bruinsburg Road is reportedly still visible on the floodplain and along the route of the climb up to the escarpment.

Construction activities on the floodplain where storage caverns would be built might affect remains associated with the troop landing or prehistoric sites and would affect the setting and feeling of the troop-landing site. Construction activities on the escarpment where the rest of the storage site facilities would be built could affect remains associated with the historic line of the march of the Vicksburg campaign or prehistoric sites.

Several measures could mitigate the effects of altering the setting at the troop-landing site, which is already changed from the original site because the river channel moved westerly and the town of Bruinsburg was abandoned. The mitigation measures could include improved access for history students to the area by the access road to the new facility, possibly including construction of a viewpoint on the descent of the escarpment. In addition, another mitigation measure might be financial support to the National Park Service interpretive program. Currently, access is possible only by special permission from the private landowner; interpretive signs are posted only along public roads, not at the actual site. Damage or destruction of archaeological remains associated with the landing and troop movements would be mitigated through avoidance, if possible, or data would be recovered if damage or destruction of the remains were not avoidable. The current conceptual design for the site, with most buildings and other surface structures on the escarpment, would minimize the effect on the landing area.

### **2.8.9 Noise**

Noise from constructing the proposed storage sites would be audible to the closest receptors for the proposed new and expansion storage sites. The estimated noise levels, however, would have minor impacts because the noise levels would be only slightly greater than the estimated ambient noise levels. The construction noise impacts along the pipelines and at other infrastructure locations also would be small. The level of noise from operations and maintenance activities would be lower than from construction activities. At several proposed storage sites, the noise levels would not be audible, that is, they would be lower than estimated ambient noise levels.

### **2.8.10 Environmental Justice**

The potentially affected populations for each alternative include low-income, Black or African American, Native American or Alaska Native, Asian, and Hispanic or Latino populations. The Stratton Ridge alternative also includes Native Hawaiian or Other Pacific Islander populations. None of these populations would have impacts that appreciably exceed the impacts to the general population. Furthermore, none of the populations would be affected in different ways than the general population, such as by having unique exposure pathways, unique rates of exposure, or special sensitivities or by using natural resources differently. Thus, there would be no disproportionately high and adverse impacts to minority or low-income populations.

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

Resource	Bruinsburg	Chacahoula	Clovelly	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge	No-Action
Environmental Risks and Public and Occupational Safety and Health	<p>Possible oil spills during initial fill. 16 oil spills predicted.</p> <p>Possible brine spills during the solution mining of caverns and fill. 96 brine spills predicted.</p> <p>Most oil, brine, or hazardous materials spills would be small and occur at storage sites where they would be controlled and kept from sensitive areas. Project lifetime risks would be low.</p> <p>Low likelihood of fire.</p> <p>Number of occupational injuries (0.83 workdays per 200,000 worker hours) would be less than similar industries, based on SPR experience.</p>	Same impacts as under Bruinsburg alternative.	Same impacts as under Bruinsburg alternative.	Same impacts as under Bruinsburg alternative.	Same impacts as under Bruinsburg alternative.	Same impacts as under Bruinsburg alternative.	Same impacts as under Bruinsburg alternative.	No impact.
Land Use: Land Use Conflicts	<p>3,470 acres committed for alternative. Most acreage would be for pipeline and power line ROWs.</p> <p>Potential minor conflict where pipeline would cross Natchez Trace National Scenic Trail and Natchez Parkway in an expanded existing ROW and where pipeline would cross 6.8 miles of proclamation area of Homochitto National Forest.</p>	<p>2,884 acres committed for alternative. Most acreage would be for pipeline and power line ROWs.</p> <p>No potential land-use conflicts.</p>	<p>693 acres committed for alternative. Most acreage would be for storage site, which would be within an existing private facility.</p> <p>No potential land-use conflicts.</p>	<p>1,757 acres committed for alternative. Most acreage would be for pipeline and power line ROWs.</p> <p>Potential minor conflict where Bruinsburg pipeline would cross Natchez Trace National Scenic Trail and Natchez Trace Parkway in existing ROW.</p>	<p>2,257 acres committed for alternative. Same land use conflicts as under Clovelly 80 MMB/Bruinsburg 80 MMB alternative.</p>	<p>4,494 acres committed for alternative. Most acreage would be for pipeline and power line ROWs.</p> <p>No potential land-use conflicts.</p>	<p>2,191 acres committed for alternative. Most acreage would be for pipeline and power line ROWs.</p> <p>Potential conflict where the pipelines and power lines would cross 3 miles and pipeline would cross 4.7 miles of Brazoria National Wildlife Refuge in existing and new ROWs, respectively.</p>	No impact.
Land Use: Visual Resources	<p>Potential visual impacts due to changes in historic Civil War landscape. Potential changes in vegetation where Bruinsburg pipeline ROW would cross Natchez Trace National Scenic Trail, Natchez Trail Parkway, and proclamation area of Homochitto National Forest.</p>	<p>No substantial visual impacts because of limited changes in viewshed, limited access, and lack of proximity to areas with visual sensitivity.</p>	<p>No substantial visual impacts because of location in existing industrial area.</p>	<p>Potential visual impact due to changes in historic Civil War landscape. Potential changes in vegetation where Bruinsburg pipeline ROW would cross Natchez Trace National Scenic Trail and Natchez Trace Parkway.</p>	<p>Same visual impacts as under Clovelly 90 MMB/Bruinsburg 80 MMB alternative.</p>	<p>Same visual impacts as Chacahoula.</p>	<p>Potential visual impact due to changes in vegetation and new power lines from ROW across Brazoria National Wildlife Refuge. Potential visual impacts from RWI across ICW from the Refuge.</p>	No impact.
Land Use: Farmland Conversion	<p>Would not have a substantial impact in converting prime and unique farmland to non-agricultural use. Farmland impact score under Farmland Protection Act regulations (7 CFR Part 658) is below level where further consideration of farmland protection is required.</p>	<p>Same farmland conversion impact as under Bruinsburg alternative.</p>	<p>Same farmland conversion impact as under Bruinsburg alternative.</p>	<p>Same farmland conversion impact as under Bruinsburg alternative.</p>	<p>Same farmland conversion impact as under Bruinsburg alternative.</p>	<p>Same farmland conversion impact as under Bruinsburg alternative.</p>	<p>Same farmland conversion impact as under Bruinsburg alternative.</p>	No impact.

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

Resource	Bruinsburg	Chacahoula	Clovelly	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge	No-Action
Land Use: Coastal Zone Management	Some of the Bruinsburg infrastructure and Big Hill site and infrastructure and West Hackberry site and infrastructure would be in coastal zones.  DOE and the state coastal zone agency will use the Clean Water Act Section 404 wetlands permitting process to reach a determination on coastal consistency.	Same coastal zone management impacts as under Bruinsburg alternative  Same coastal zone determination process as under Bruinsburg alternative.	Clovelly site, some of the Bruinsburg infrastructure, Big Hill site and infrastructure, and West Hackberry site would be in coastal zones.  Same coastal zone determination process as under Bruinsburg alternative.	Clovelly site, Big Hill site and infrastructure, and West Hackberry site would be in coastal zones.  Same coastal zone determination process as under Bruinsburg alternative.	Same coastal zone management impacts as under Clovelly 80 MMB/ Bruinsburg 80 MMB alternative.  Same coastal zone determination process as under Bruinsburg alternative.	Some of Richton infrastructure, Big Hill site and infrastructure, and West Hackberry site would be in coastal zones.  Same coastal zone determination process as under Bruinsburg alternative.	Stratton Ridge site and infrastructure, Big Hill site and infrastructure, and West Hackberry site would be in coastal zones.  Same coastal zone determination process as under Bruinsburg alternative.	No impact.
Geology and Soils	Potential minor surface subsidence (2.6 to 6.1 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome.	Potential minor surface subsidence (1.8 to 6.4 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome.	Potential minor surface subsidence (5 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome.	Potential minor surface subsidence (2.8 to 6.4 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome.	Potential minor surface subsidence (1 to 3 feet at Bruinsburg salt dome and 2.1 to 4.9 feet at Clovelly salt dome, over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome.	Potential minor surface subsidence (1 to 3 feet at Bruinsburg and slightly more than 2.1 to 4.9 feet at Clovelly salt dome, over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome.	Potential minor surface subsidence (2.6 to 6.1 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome.	No potential subsidence, except possibly from future outside development of Chacahoula and Stratton Ridge salt domes.
Air Quality	Low airborne emissions from construction activities would not exceed National Ambient Air Quality Standards.  Emissions levels would be below levels of concern, including below conformity determination thresholds in the ozone nonattainment areas at Bayou Choctaw and Big Hill.  Low emissions of greenhouse gases from construction equipment and motor vehicles.	Same air quality impacts as under Bruinsburg alternative.	Same air quality impacts as under Bruinsburg alternative.	Same air quality impacts as under Bruinsburg alternative.	Same air quality impacts as under Bruinsburg alternative.	Same air quality impacts as under Bruinsburg alternative.	Same as Bruinsburg, except that emission levels would be below the conformity determination threshold in the ozone nonattainment areas at Stratton Ridge. Since estimated levels are only slightly below level that triggers a full conformity review, DOE would conduct additional analysis if Stratton Ridge were selected.	No impact.
Water Resources: Surface Water	Construction activities would cause temporary and minor erosion and sedimentation. DOE would secure an Erosion and Sediment Control Permit and NPDES stormwater permit for construction activities. No significant water quality problems would result.  Construction and operation would potentially affect 35 waterbodies for Bruinsburg site and infrastructure and 12, 4, and 3 water bodies for the expansions at Bayou Choctaw, Big Hill, and West Hackberry, respectively.	Same erosion and sedimentation impacts as under Bruinsburg alternative.  Chacahoula site and infrastructure would potentially affect 18 waterbodies. Same waterbodies for expansion sites as under Bruinsburg alternative.	Same erosion and sedimentation impacts as under Bruinsburg alternative.  Clovelly site and infrastructure would potentially affect 4 water bodies and a small amount of dredging and filling of existing canals would be required at Chacahoula. Same water bodies for expansion sites as under Bruinsburg alternative.	Same erosion and sedimentation impacts as individual Clovelly and Bruinsburg alternatives, but the disturbance footprint at each site would be smaller.  Clovelly 80 MMB/Bruinsburg 80 MMB and Clovelly site and infrastructure would potentially affect 16 waterbodies. Same water bodies for expansion sites as under Bruinsburg alternative.	Same erosion and sedimentation impacts as Clovelly 80 MMB/Bruinsburg 80 MMB alternative.  Same water bodies affected as under Clovelly 80 MMB/ Bruinsburg 80 MMB alternative.	Same erosion and sedimentation impacts as under Bruinsburg alternative.  Richton site and infrastructure would potentially affect 63 water bodies. Same water bodies for expansion sites as under Bruinsburg alternative.	Same erosion and sedimentation impacts as under Bruinsburg alternative.  Stratton Ridge site and infrastructure would potentially affect 17 waterbodies. Same water bodies for expansion sites as under Bruinsburg alternative.	No impact unless Chacahoula or Clovelly were developed by a commercial entity.

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

Resource	Bruinsburg	Chacahoula	Clovelly	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge	No-Action
Water Resources: Surface Water (continued)	<p>DOE would secure a Section 404 permit and Section 401 Water Quality Certificate for construction activities in jurisdictional waterbodies.</p> <p>There would be a potential for significant water quality consequences if a brine or oil release occurred and it traveled into a waterbody. The risk of such a release is small based on the history of existing SPR facilities.</p> <p>Bruinsburg RWI would withdraw 50 million gallons/day for 4 to 5 years from Mississippi River, which is a small fraction of its flow.</p> <p>Big Hill and West Hackberry expansions would use existing RWIs from ICW without changing existing conditions. Bayou Choctaw would withdraw 25 million gallons/day from Cavern Lake, which is fed by the ICW, for up to 3 years. Withdrawals would not significantly alter the flow or volume of water, but may cause a slight upstream migration of the salinity gradient.</p>	<p>Same requirements as under Bruinsburg alternative for construction activities in jurisdictional waterbodies.</p> <p>Same spill risk as under Bruinsburg alternative.</p> <p>Chacahoula RWI would withdraw 50 million gallons/day for 4 to 5 years from the ICW, a tidally influenced waterbody. Withdrawal would not significantly change the ICW water flow or volume, but may cause a slight upstream migration of the salinity gradient.</p> <p>The impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be the same as under Bruinsburg alternative.</p>	<p>Same requirements as under Bruinsburg alternative for construction activities in jurisdictional waterbodies.</p> <p>Same spill risk as under Bruinsburg alternative.</p> <p>Clovelly RWI would withdraw 50 million gallons/day for 4 to 5 years from a tidal canal in network of interconnected canals at LOOP complex. Withdrawal would not significantly change flow or volume of water in the canal system, but may cause a slight upstream migration of the salinity gradient.</p> <p>The impact from water withdrawal for the Bayou Choctaw, Big Hill, and West Hackberry expansions would be the same as under Bruinsburg alternative.</p>	<p>Same requirements as under Bruinsburg alternative for construction activities in jurisdictional waterbodies.</p> <p>Same spill risk as under Bruinsburg alternative.</p> <p>Clovelly and Bruinsburg RWIs would have a similar but impact as Clovelly RWI and Bruinsburg RWI, except withdrawals would occur for a shorter duration.</p> <p>Impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be the same as under Bruinsburg alternative.</p>	<p>Same requirements as under Bruinsburg alternative for construction activities in jurisdictional waterbodies.</p> <p>Same spill risk as under Bruinsburg alternative.</p> <p>Similar impact from RWI as under Clovelly 80MMB/ Bruinsburg 80 MMB alternative, except that water withdrawal would have a slightly longer duration.</p> <p>Impact from water withdrawal would be similar as under Clovelly 80MMB/Bruinsburg 80 MMB alternative, except that the brine discharge for Clovelly would have a slightly longer duration.</p>	<p>Same requirements as under Bruinsburg alternative for construction activities in jurisdictional waterbodies.</p> <p>Same spill risk as under Bruinsburg alternative.</p> <p>Richton RWI would withdraw 50 million gallons/day for 4 to 5 years from the Leaf River, which would be about 2 percent of average flow rate. Withdrawal would potentially exceed the 7-day, 10 year low flow rate, which is the minimum instream flow allowed by Mississippi. Historical data show that Leaf River flow would be sufficient to meet the water demand about 99 percent of the time. During low flow years, flow could be below the minimum instream flow for up to 15 percent of the time. DOE would secure a Beneficial Use of Public Waters Permit from Mississippi.</p> <p>Impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be same as under Bruinsburg alternative.</p>	<p>Same requirements as under Bruinsburg alternative for construction activities in jurisdictional waterbodies.</p> <p>Same spill risk as under Bruinsburg alternative.</p> <p>Stratton Ridge RWI would withdraw 42 million gallons/day for 4 to 5 years from ICW, a tidally influenced waterbody. Withdrawal would not significantly change the ICW water flow or volume, but may cause a slight upstream migration of the salinity gradient.</p> <p>Impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be the same as under Bruinsburg alternative.</p>	

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

Resource	Bruinsburg	Chacahoula	Clovelly	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge	No-Action
Water Resources: Surface Water (continued)	<p>No discharge from Bruinsburg to Gulf of Mexico. Brine would be injected underground.</p> <p>Big Hill expansion would discharge brine into Gulf of Mexico using existing brine diffusers and within existing NPDES permitted limits. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand) would occur from the discharge, but increase would be within natural salinity variation.</p>	<p>Chacahoula site would discharge brine into Gulf of Mexico for up to 3 years. Discharge would be located in a trough to the north of Ship Shoal, an important fishing area. Brine plume would typically not affect Ship Shoal although a minor salinity increase may occur under some ocean conditions. DOE would secure a National Pollutant Discharge Elimination System permit from Louisiana. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand) would occur from the discharge but the increases would be within natural salinity variation.</p> <p>Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative.</p>	<p>Clovelly site would discharge brine into Gulf of Mexico using an existing brine diffuser system and within existing National Pollutant Discharge Elimination System permitted limits. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand) would occur from the discharge, but the increase would be within natural salinity variation.</p> <p>Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative.</p>	<p>Clovelly site would have a similar impact to the brine discharge from the Clovelly alternative, except that discharge would have a shorter duration.</p> <p>Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative.</p>	<p>Same brine discharge impact as under Clovelly 80 MMB/ Bruinsburg 80 MMB alternative, except that discharge would have a shorter duration.</p>	<p>Richton site would discharge brine into Gulf of Mexico using up to 75 diffusers. DOE would secure an NPDES discharge permit from the Mississippi DEQ. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand) would occur from the discharge, but the increases would be within natural salinity variation.</p> <p>Impact of Big Hill brine discharge would be the same as under Bruinsburg alternative.</p>	<p>Stratton Ridge site would discharge brine into the Gulf of Mexico using up to 75 diffusers. DOE would secure a National Pollutant Discharge Elimination System permit from Texas for the brine discharge. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand) would occur from the discharge but the increases would be within natural salinity variation.</p> <p>Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative.</p>	
Water Resources: Groundwater	<p>Bruinsburg pipelines would cross multiple areas with programs protecting against contaminating groundwater that is used as a source of drinking water (source water protection areas); however, risk of groundwater contamination from pipeline spills is low.</p> <p>Bruinsburg, Bayou Choctaw, and West Hackberry would use deep-aquifer brine injection. These sites have confined aquifers separated by impermeable strata. The proposed brine injection wells would be permitted by U.S. Environmental Protection Agency and/or appropriate state agency.</p>	<p>Chacahoula pipelines would not cross source water protection areas.</p> <p>Bayou Choctaw and West Hackberry use deep-aquifer brine injection. These sites have confined aquifers separated by impermeable strata. The proposed brine injection wells would be permitted by U.S. Environmental Protection Agency and/or appropriate state agency.</p>	<p>Existing pipelines at Clovelly do not cross source water protection areas. Shallow groundwater at Clovelly is not potable. Any discharge to groundwater would have little impact on water use in area. Relatively impermeable clay/silt layer overlays the aquifer system.</p> <p>Brine injection at Bayou Choctaw and West Hackberry would be same as under Chacahoula alternative.</p>	<p>Impacts to groundwater are similar to those discussed for Bruinsburg alternative and Clovelly alternative, except that the number of brine injection wells at Bruinsburg would be reduced from 60 to 30.</p>	<p>Impacts to groundwater would be same as under Clovelly 80/Bruinsburg 80 MMB alternative.</p>	<p>Richton pipelines would be constructed through and adjacent to several groundwater protection areas; however, risk of groundwater contamination from pipeline spills is low.</p> <p>Brine injection at Bayou Choctaw and West Hackberry would be same as under Chacahoula alternative.</p>	<p>Stratton Ridge pipelines would be constructed through and adjacent to several areas serving public water systems or important to groundwater recharge; however, risk of groundwater contamination from pipeline spills is low.</p> <p>Brine injection at Bayou Choctaw and West Hackberry would be same as under Chacahoula alternative.</p>	No impact.

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

Resource	Bruinsburg	Chacahoula	Clovelly	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge	No-Action
Water Resources: Groundwater (Continued)	At Bruinsburg, the total disposal capacity of the proposed injection formations and the pressure build-up likely to occur as a result of brine injection are currently unknown. If DOE were to select this alternative, the total disposal capacity and pressure build-up would be determined during the development of the detailed design.							
Water Resources: Floodplains	<p>Construction of Bruinsburg storage site, three expansion storage sites, RWIs, and other facilities except ROWs would affect 276 acres of 100-year floodplain and 48 acres of 500-year floodplain. Buildings at Bruinsburg would not be in floodplain. Wellheads, well pads, and roads would involve placing fill or infrastructure in a floodplain. DOE would comply with floodplain protection requirements during design and construction so that the base flood elevation and downstream land uses would not be significantly affected.</p> <p>ROWs for the Bruinsburg site and three expansion sites would temporarily affect 48 miles of 100-year floodplain and 7 miles of 500-year floodplain. Floodplain would not be permanently affected by the ROWs because no aboveground fill or structures would be placed in the floodplain after construction is complete.</p>	<p>Construction of Chacahoula storage site, three expansion storage sites, RWIs, and other facilities except ROWs would affect 171 acres of 100-year floodplain and 27 acres of 500-year floodplain, much of which would be filled. Some interior areas of the storage site would not be filled and would retain their flood storage capacity. The entire storage site at Chacahoula is located in a vast floodplain that extends to the Gulf of Mexico. Site floodplain requirements and impacts would be same as under Bruinsburg alternative.</p> <p>ROWs for the Chacahoula site and three expansion sites would temporarily affect 109 miles of 100-year and 3 miles of 500-year floodplain. ROW floodplain impacts would be same as under Bruinsburg alternative.</p>	<p>Construction of Clovelly storage site, three expansion storage sites, RWIs, and other facilities except ROWs would affect 56 acres of 100-year floodplain and 27 acres of 500-year floodplain. All of the Clovelly site would be located in the floodplain, but the facility would be built on an elevated platform that would place much of the infrastructure above the base flood elevation. Administrative buildings would be located offsite and out of the floodplain. Site floodplain requirements and impacts would be same as under Bruinsburg alternative.</p> <p>ROWs for the Bruinsburg site and three expansion sites would temporarily affect 18 miles of 100-year floodplain and 3 miles of 500-year floodplain. ROW floodplain impacts would be same as under Bruinsburg alternative.</p>	<p>Construction of the Clovelly and Bruinsburg storage sites, three expansion storage sites, RWIs, and other facilities except ROWs would affect 136 acres of 100-year floodplain and 48 acres of 500-year floodplain. Site floodplain requirements and impacts would be same as under Bruinsburg alternative.</p> <p>ROWs for the Clovelly-Bruinsburg alternative, including three expansion sites would temporarily affect 55 miles of 100-year and 7 miles of 500-year floodplain. ROW floodplain impacts would be same as under Bruinsburg alternative.</p>	Same floodplain impacts as under Clovelly 80 MMB/ Bruinsburg 80 MMB alternative.	<p>Construction of Richton storage site, three expansion storage sites, RWIs, and other facilities except ROWs would affect 98 acres of 100-year floodplain and 27 acres of 500-year floodplain. Site floodplain requirements and impacts would be same as under Bruinsburg alternative.</p> <p>ROWs for the Bruinsburg site and three expansion sites would temporarily affect 45 miles of 100-year floodplain and 6 miles of 500-year floodplain. ROW floodplain impacts would be same as under Bruinsburg alternative.</p>	<p>Construction of Stratton Ridge storage site, three expansion storage sites, RWIs, and other facilities except ROWs would affect 159 acres of 100-year floodplain and 213 acres of 500-year floodplain. Site floodplain requirements and impacts would be same as under Bruinsburg alternative.</p> <p>ROWs for the Stratton Ridge site and three expansion sites would temporarily affect 59 miles of 100-year and 11 miles of 500-year floodplain. ROW floodplain impacts would be same as under Bruinsburg alternative.</p>	No impact.

Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Clovelly	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge	No-Action
Biological Resources: Plants, Wetlands, and Wildlife	<p>Construction of Bruinsburg storage site, three expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 150 acres of wetlands including 85 acres of relatively rare and ecologically important bald cypress forest for the storage site area. Security buffer at Bruinsburg, West Hackberry, and Big Hill storage sites would cause a permanent conversion of 25 acres of forested and scrub-shrub wetlands to emergent wetlands.</p> <p>Proposed ROWs for Bruinsburg and three expansion sites would affect 211 acres of wetlands within the permanently maintained easement and 306 acres within the temporary construction easement.</p> <p>Wetlands in the permanently maintained easement would be converted to emergent wetlands and would be periodically maintained to suppress woody species. Wetlands within the temporary construction easement would be cleared during construction, but would re-establish within 5-25 years depending on the type of wetland affected.</p>	<p>Construction of Chacahoula site, three expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 175 acres of wetlands including 126 acres of ecologically and economically important bald cypress forest for the storage site area. The clearing of an additional 213 acres of bald cypress and other forested wetlands for security at Chacahoula and the expansion sites would be a permanent conversion to emergent wetlands or open water.</p> <p>Proposed ROWs for Chacahoula and three expansion sites would affect 867 acres of wetlands within the permanently maintained easement and 1,222 acres within the temporary construction easement.</p> <p>The nature of the wetland impacts would be same as under Bruinsburg alternative.</p>	<p>Construction of Clovelly storage site, three expansion storage sites, RWIs, and other facilities except ROWs would permanently fill or dredge 49 acres of disturbed and relatively low value wetlands. It would cause a permanent conversion of 7 acres of forested and scrub-shrub wetland to emergent wetlands for security and other clearing at Clovelly, Big Hill, and West Hackberry.</p> <p>Proposed Clovelly site does not require pipeline or power line ROW construction. The proposed ROWs for three expansion sites would affect 60 acres of wetlands within the permanently maintained easement and 122 acres within the temporary construction easement.</p> <p>The nature of the wetland impacts would be same as under Bruinsburg alternative.</p>	<p>Construction of the Clovelly and Bruinsburg storage sites, three expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 86 acres of wetlands, including up to 39 acres of relatively rare and ecologically important bald cypress forest for the site storage area at Bruinsburg. It would cause a permanent conversion of 23 acres of forested and scrub-shrub wetland to emergent wetlands for security and other clearing at Clovelly, Big Hill, and West Hackberry.</p> <p>Proposed ROWs for Clovelly-Bruinsburg and the three expansion sites would affect 251 acres of wetlands within the permanently maintained easement and 398 acres within the temporary construction easement.</p> <p>The nature of the wetland impacts would be same as under Bruinsburg alternative.</p>	<p>Same wetlands impacts as under Clovelly 80 MMB/ Bruinsburg 80 MMB alternative.</p>	<p>Construction of Richton storage site, three expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 90 acres of wetlands, including 34 acres of disturbed low value emergent wetlands at the Pascagoula terminal site. Security buffer at Richton, Big Hill, and West Hackberry storage sites would cause a permanent conversion of 9 acres of forested and scrub-shrub wetlands to emergent wetlands.</p> <p>The proposed ROWs for Richton and the three expansion sites would affect 527 acres of wetlands within the permanently maintained easement and 907 acres within the temporary construction easement.</p> <p>The nature of the wetland impacts would be same as under Bruinsburg alternative.</p>	<p>Construction of Stratton Ridge storage site, three expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 277 acres of wetlands, including up to 258 acres of relatively rare and ecologically important bottomland hardwood for the site storage area. Security buffer at Stratton Ridge, West Hackberry, and Big Hill storage sites would cause a permanent conversion of 80 acres of forested and scrub-shrub wetlands to emergent wetlands.</p> <p>The proposed ROWs for Stratton Ridge and the three expansion sites would affect 181 acres of wetlands within the permanently maintained easement and 288 acres within the temporary construction easement.</p> <p>The nature of the wetland impacts would be same as under Bruinsburg alternative.</p>	No impact.

Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Clovelly	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge	No-Action
Biological Resources: Plants, Wetlands, and Wildlife (continued)	Impact from permanent filling of wetlands and permanent conversion would be a potentially adverse affect because of the impact size and the regional importance of the forested wetlands, but would be mitigated. DOE would complete a wetland delineation, secure a jurisdictional determination, and secure Section 404/401 permits for all impacts to jurisdictional wetlands. DOE would develop a comprehensive plan to further avoid and minimize wetland impacts and to mitigate for unavoidable impacts to jurisdictional wetlands by creating, restoring, or preserving wetlands, contributing an in-lieu of fee, or purchasing credits from a mitigation bank.	The impact from the permanent filling of wetlands and permanent conversion would be the same as under Bruinsburg alternative.	The impact from permanent filling of wetlands and permanent conversion would be relatively moderate because the wetlands have already been disturbed by past development, have been invaded by tallow tree, and they are not regionally important. DOE would undertake the same wetland activities as under the Bruinsburg alternative.	The impact from the permanent filling of wetlands and permanent conversion would be the same as under Bruinsburg alternative.		The impact from ROWs is a potentially adverse affect because of the size of the impact (over 600 acres) to palustrine forested and scrub-shrub wetlands. The impact would be mitigated. DOE would undertake the same wetland activities as under Bruinsburg alternative.	The impact from the permanent filling of wetlands and permanent conversion is a potentially adverse affect because of the size of the impact and the regional importance of the forested wetlands. Some of the forested wetlands at the Stratton Ridge site have relatively low ecological value because of invasion by exotic plants and animals. DOE would undertake the same wetland activities as under Bruinsburg alternative.	

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

Resource	Bruinsburg	Chacahoula	Clovelly	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge	No-Action
Biological Resources: Threatened and Endangered Species	<p>Proposed ROW for Bruinsburg may affect the fat pocketbook mussel, a Federally endangered species, which may be present in Coles and Fairchild Creeks. Proposed RWI for the Bruinsburg site may affect the pallid sturgeon, a Federally endangered species that lives in the Mississippi River because of the potential for impingement and entrainment of juveniles. DOE would initiate formal Section 7 consultation with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if project may adversely affect these species.</p> <p>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any Federally listed species.</p>	<p>Proposed site storage area for the Chacahoula site and all proposed ROWs may affect the Bald Eagle, a Federally threatened species that is proposed for de-listing, by removing potential foraging, roosting, and nesting habitat. Proposed ROW for the crude oil pipeline to Clovelly may affect the brown pelican, which is a Federally endangered species. The brown pelican has roosting habitat near the proposed ROW. DOE would initiate formal Section 7 consultation with USFWS and prepare a Biological Assessment, and implement conditions of Biological Opinion if project may adversely affect these species.</p> <p>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any Federally listed species.</p>	<p>Proposed Clovelly site would not affect any Federally listed species.</p> <p>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any Federally listed species.</p>	<p>Bruinsburg RWI may affect the pallid sturgeon in the same way as under Bruinsburg alternative, but the fat pocketbook mussel would not be affected because Bruinsburg 80 MMB proposed pipelines and shorter brine pipeline would not cross waterbodies inhabited by the mussel.</p> <p>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any Federally listed species.</p>	<p>Same as Clovelly 80 MMB/ Bruinsburg 80 MMB alternative.</p>	<p>The proposed storage site, ROWs, and RWI may affect the Federally threatened gopher tortoise and the Federal candidate black pine snake. Potential impacts include loss of habitat or individuals from the construction. Proposed RWI may affect the Federally endangered yellow blotched map turtle and Gulf sturgeon, and the Federal candidate pearl darter. The adverse affect may occur because of the potential for impingement and entrainment of early life stages and because the withdrawal could change the hydrological regime preferred by these species. RWI would be located within the segment of the Leaf River, which is designated as critical habitat for the Gulf sturgeon. According to historical flow records, about 27 percent of the time, the withdrawal would exceed the minimum instream flow recommended by Mississippi to protect freshwater fisheries. DOE would initiate formal Section 7 consultation with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if project may adversely affect a listed species or designated critical habitat.</p> <p>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any Federally listed species.</p>	<p>The proposed site storage area for the Stratton Ridge site, ROWs, and RWI may affect the Bald Eagle, a Federally threatened species that is proposed for de-listing, by removing potential foraging, roosting, and nesting habitat. The Bald Eagle has not been reported within the corridor. DOE would initiate formal Section 7 consultation with USFWS and prepare a Biological Assessment, and implement conditions of Biological Opinion if project may adversely affect these species or designated critical habitat.</p> <p>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any Federally listed species.</p>	No impact.

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

Resource	Bruinsburg	Chacahoula	Clovelly	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge	No-Action
Biological Resources: Special Status Areas	<p>The pipeline ROW to the Peetsville terminal would cross Natchez Trace Parkway, which is managed by the National Park Service (NPS). The proposed ROW follows existing utility and road corridors and is already disturbed. DOE would coordinate with the NPS to minimize the impacts to important natural resources.</p> <p>Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas.</p>	No special status areas would be affected by this alternative.	<p>Clovelly site would be located adjacent to the Gulf ICW to Clovelly Hydrologic Restoration project, but would not affect the project.</p> <p>Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status sites.</p>	No special status areas would be affected by this alternative.	No special status areas would be affected by this alternative.	<p>Pipeline to Liberty terminal would pass through 0.5 miles of the Percy Quin State Park. DOE would coordinate with the state park to select a route that would minimize the impacts to important natural and recreational resources.</p> <p>Bayou Choctaw, Big Hill, and West Hackberry expansions would not affect any special status areas.</p>	<p>Crude oil pipeline ROW to Texas City and RWI, brine, and power line ROW would each pass through a portion of the Brazoria National Wildlife Refuge. RWI would be located across the ICW from the refuge. RWI construction and operations may affect sensitive wildlife and migrating birds that inhabit or stop at the refuge. DOE would coordinate with the USFWS and negotiate a final route and construction approach that minimizes the impact to natural resources. DOE would bury the power line through the refuge and use noise attenuation, down-shielded and low mast lighting at RWI to minimize impacts.</p> <p>Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas.</p>	No impact.
Biological Resources: Essential Fish Habitat	Big Hill expansion would cause minor salinity changes from the brine discharge to a small area of EFH in the Gulf of Mexico (modeling indicated a maximum increase of 4.7 parts per thousand). Impact to EFH would be minimal because it represents a very small fraction of the total EFH in the Gulf of Mexico and the managed species are generally tolerant of wider salinity changes than the predicted increase due to the brine discharge.	Chacahoula and Big Hill would have EFH impacts similar to Bruinsburg alternative. Chacahoula would discharge brine near Ship Shoal, an important fishing area. A small salinity increase may be experienced at Ship Shoal. Brine discharge pipeline construction would disturb 1,470,000 square feet of sediment that is EFH.	Clovelly and Big Hill expansion sites would have EFH impacts same as the impacts from Big Hill under Bruinsburg alternative.	Similar impact as under the Clovelly alternative, except that the brine discharge for the Clovelly and Bruinsburg alternative would have a shorter duration.	Similar impact to the Clovelly 80 MMB/Bruinsburg 80 MMB alternative, except that the brine discharge would have a slightly longer duration.	Richton and Big Hill expansion sites would have EFH impacts same as the impacts from Big Hill under Bruinsburg alternative. Brine pipeline construction would disturb 1,062 square feet of sediment that is EFH.	Stratton Ridge and Big Hill expansion sites would have EFH impacts same as the impacts from Big Hill under Bruinsburg alternative. Brine disposal pipeline construction would disturb 320,000 square feet of sediment that is EFH.	No impact.
Socioeconomics	<p>Peak construction workforce of 474 for Bruinsburg site and its infrastructure.</p> <p>Peak construction workforce of 100 to 350 employees at expansion sites.</p> <p>Operations and maintenance workforce of 75 to 100 employees at Bruinsburg site and an additional 25 employees at each expansion site.</p>	<p>Peak construction workforce of 445 for Chacahoula and its infrastructure.</p> <p>Same expansion site workforce as under Bruinsburg alternative.</p> <p>Same operations and maintenance workforce as under Bruinsburg alternative.</p>	<p>Peak construction workforce of 238 for Clovelly and its infrastructure.</p> <p>Same expansion site workforce as under Bruinsburg alternative.</p> <p>Same operations and maintenance workforce as under Bruinsburg alternative.</p>	<p>Peak construction workforce of 548 for Clovelly and Bruinsburg and their infrastructure.</p> <p>Same expansion site workforce as under Bruinsburg alternative.</p> <p>Same operations and maintenance workforce as under Bruinsburg alternative, except that there would be 75 to 100 employees at both Clovelly and Bruinsburg.</p>	<p>Same as Clovelly 80 MMB/ Bruinsburg 80MMB.</p> <p>Same expansion site workforce as under Bruinsburg alternative.</p> <p>Same operations and maintenance workforce as under Clovelly 80 MMB/ Bruinsburg 80 MMB alternative.</p>	<p>Peak construction workforce of 499 for Richton and its infrastructure.</p> <p>Same expansion site workforce as under Bruinsburg alternative.</p> <p>Same operations and maintenance workforce as under Bruinsburg alternative.</p>	<p>Peak construction workforce of 431 for Stratton Ridge and its infrastructure.</p> <p>Same expansion site workforce as under Bruinsburg alternative.</p> <p>Same operations and maintenance workforce as under Bruinsburg alternative.</p>	No impact; additional economic impact would not be generated.

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

Resource	Bruinsburg	Chacahoula	Clovelly	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge	No-Action
Socioeconomics (continued)	Positive local economic benefits from increased employment. Small in-migration relative to regional population. No noticeable increase in competition for employment, traffic, or demand for housing or public infrastructure or services.	Similar socioeconomic impacts as under Bruinsburg alternative.	Similar socioeconomic impacts as under Bruinsburg alternative.	Similar socioeconomic impacts as under Bruinsburg alternative.	Similar socioeconomic impacts as under Bruinsburg alternative.	Similar socioeconomic impacts as under Bruinsburg alternative.	Similar socioeconomic impacts as under Bruinsburg alternative.	
Cultural Resources	<p>Adverse effects to archaeological remains of Civil War activity at Bruinsburg, which could be mitigated. Residual (after mitigation) adverse effects on setting of Civil War landing area and march route.</p> <p>Possible effects to Native American sites at Big Hill, Bayou Choctaw, and West Hackberry, which could be mitigated.</p>	<p>Likely adverse effects to Native American and historic sites along Chacahoula pipeline routes, which could be mitigated.</p> <p>Possible effects to Native American sites at Big Hill, Bayou Choctaw, and West Hackberry, which could be mitigated.</p>	<p>Unlikely residual adverse effects at Clovelly.</p> <p>Possible effects to Native American sites at Big Hill, Bayou Choctaw, and West Hackberry, which could be mitigated.</p>	Same as Bruinsburg and Clovelly alternatives together.	Same as Bruinsburg and Clovelly alternatives together.	<p>Adverse effects to Native American archaeological sites within Richton facility boundary, which could be mitigated. Likely adverse effects to Native American archeological sites along Richton pipelines, which could be mitigated. Possible residual effects to feeling and setting of historic districts along pipelines and at terminal.</p> <p>Possible effects to Native American sites at Big Hill, Bayou Choctaw, and West Hackberry, which could be mitigated.</p>	<p>Adverse effects to Native American archaeological sites at Stratton Ridge facility and along pipelines, which could be mitigated. Possible residual effects to any historic settings along pipelines.</p> <p>Possible effects to Native American sites at Big Hill, Bayou Choctaw, and West Hackberry, which could be mitigated.</p>	No impact.
Noise	<p>Noise from construction activities at the new and expansion sites would be audible, but the impacts would be minor.</p> <p>Noise from operations and maintenance activities would be audible only at the expansion storage sites, where the impacts would be minor.</p> <p>Noise from construction and operations and maintenance activities at the pipelines, terminals, and other infrastructure would have minor impacts.</p>	Similar noise impacts as under Bruinsburg alternative, except that noise from operations and maintenance activities at the new site would be audible, but the impacts would be minor.	Similar noise impacts as under Bruinsburg alternative.	Similar noise impacts as under Bruinsburg alternative.	Similar noise impacts as under Bruinsburg alternative.	Similar noise impacts as under Chacahoula alternative.	Similar noise impacts as under Chacahoula.	No impact.

Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Clovelly	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge	No-Action
Environmental Justice	The potentially affected populations include low-income, Black or African American, Native American or Alaska Native, Asian, and Hispanic or Latino populations. None of these populations would have impacts that appreciably exceed the impacts to the general population, or would be affected in different ways than the general population. Thus, there would be no disproportionately high and adverse impacts to low-income or minority populations.	Same environmental justice impacts as under Bruinsburg alternative.	Same environmental justice impacts as under Bruinsburg alternative.	Same environmental justice impacts as under Bruinsburg alternative.	Same environmental justice impacts as under Bruinsburg alternative.	Same environmental justice impacts as under Bruinsburg alternative.	Same noise impacts as under Bruinsburg alternative, except that the potentially affected communities also include Native Hawaiian or Other Pacific Islander communities.	No impact.

**Table 2.8-2: Comparison of Impacts for Alternatives with Two Expansion Sites**

Resource	Bruinsburg	Chacahoula	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge
Environmental Risks and Public and Occupational Safety and Health	An increase of less than 0.1 predicted oil spills from the value presented in Table 2.8-1.  An increase of 7 more predicted oil spills than presented in Table 2.8-1.  No other notable changes.	*	*	A decrease of less than 0.2 predicted oil spills from the value presented in Table 2.8-1.  *	*	*
Land Use: Land Use Conflicts	A decrease of 81 acres from the value presented in Table 2.8-1.  No change in land use conflicts as presented in Table 2.8-1.	*	*	*	*	*
Land Use: Visual Resources	No notable change from Table 2.8-1.	*	*	*	*	*
Land Use: Farmland	A decrease of 120 acres of converted farmland from the value presented in Table 2.8-1.	*	*	*	*	*
Land Use: Coastal Zone Management	The coastal zone associated with West Hackberry would not be affected.	*	*	*	*	*
Geology and Soils	No notable change from Table 2.8-1.	*	*	*	*	*
Air Quality	No notable change from Table 2.8-1.	*	*	*	*	*
Water Resources: Surface Water	The three water bodies at West Hackberry would not be affected by construction activities.	*	*	*	*	*
Water Resources: Groundwater	No additional risk to the sole-source aquifer from increased brine disposal at West Hackberry.	*	*	*	*	*
Water Resources: Floodplains	No notable change from Table 2.8-1.	*	*	*	*	*
Biological Resources: Plants, Wetlands, and Wildlife	A decrease of 5 acres of affected wetlands from the value presented in Table 2.8-1.	*	*	*	*	*
Biological Resources: Threatened and Endangered Species	*	*	*	*	*	*
Biological Resources: Special Status Areas	No notable change from Table 2.8-1.	*	*	*	*	*
Biological Resources: Essential Fish Habitat	No notable change from Table 2.8-1.	*	*	*	*	*

**Table 2.8-2: Comparison of Impacts for Alternatives with Two Expansion Sites**

Resource	Bruinsburg	Chacahoula	Clovelly 80 MMB/ Bruinsburg 80 MMB	Clovelly 90 MMB/ Bruinsburg 80 MMB	Richton	Stratton Ridge
Socioeconomics	A construction workforce at West Hackberry would not be required. No increase in operations and maintenance workforce at West Hackberry. No local economic benefits from increased employment.	*	*	*	*	*
Cultural Resources	No possible effects to Native American sites at West Hackberry.	*	*	*	*	*
Noise	No notable change from Table 2.8-1.	*	*	*	*	*
Environmental Justice	No notable change from Table 2.8-1.	*	*	*	*	*

\* Same impacts as under Bruinsburg alternative.

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